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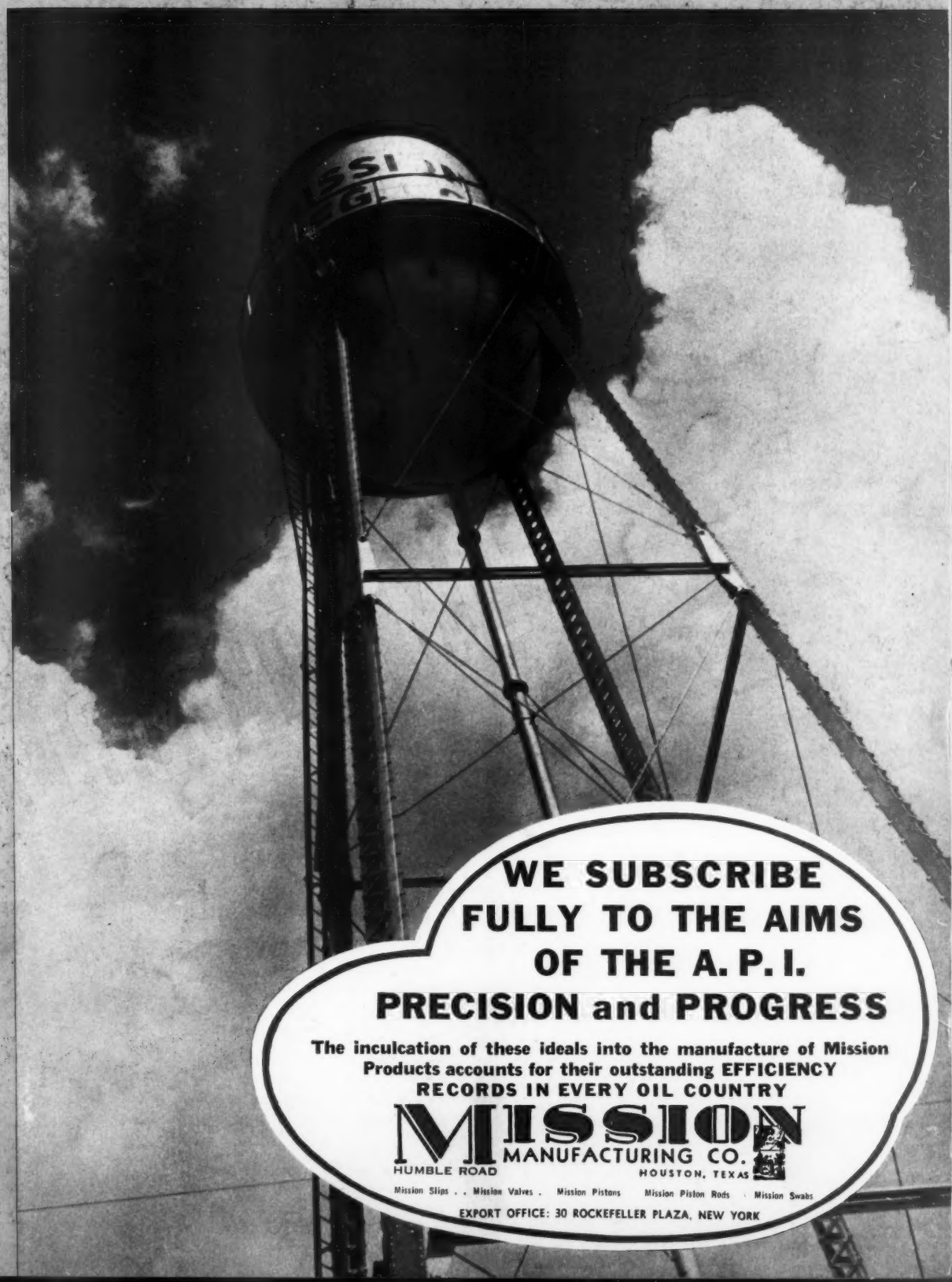

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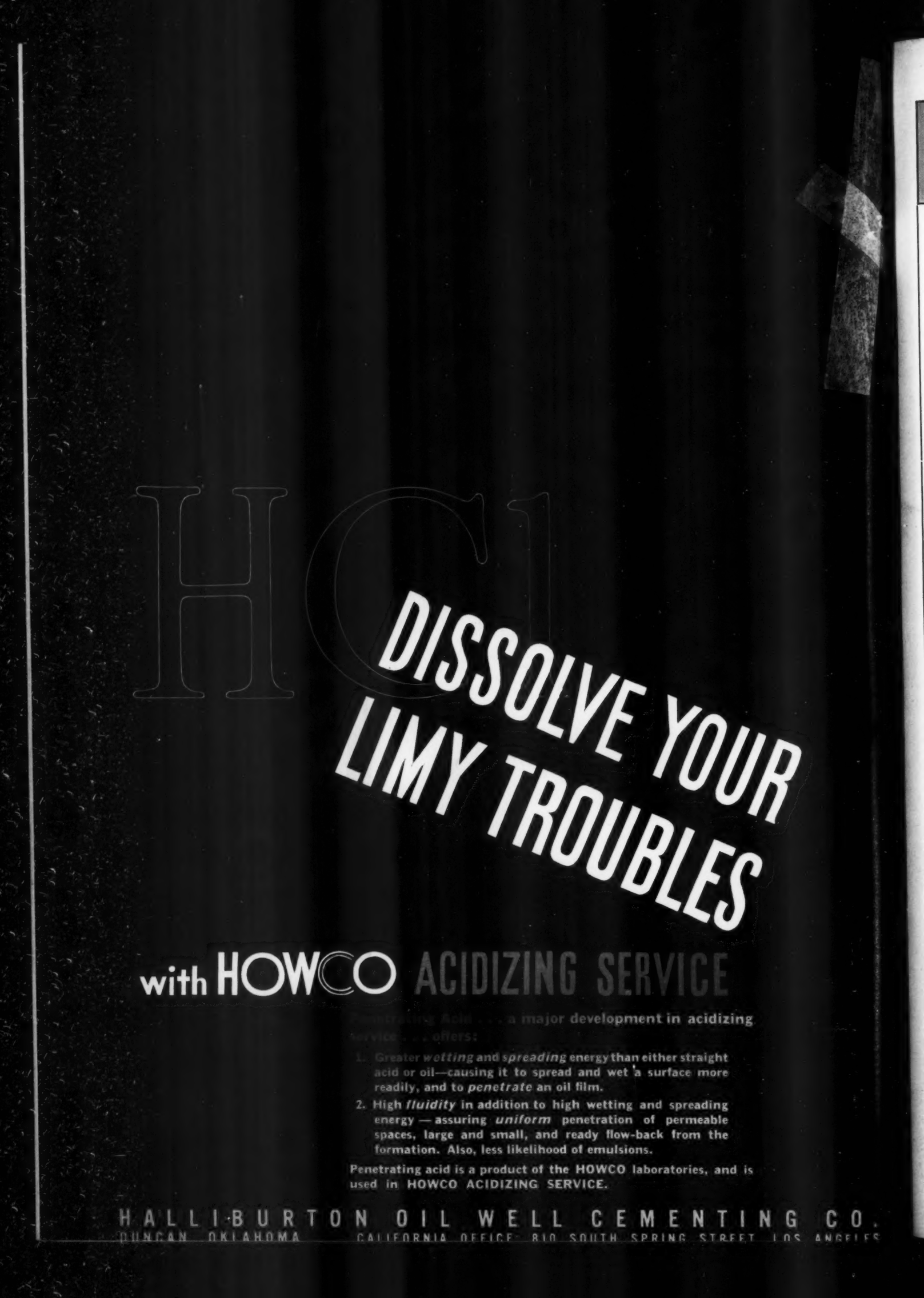
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TALK "NATURAL"

WITH

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IT'S A "NATURAL"

OVER A QUARTER OF A CENTURY IN THE NATURAL GASOLINE INDUSTRY

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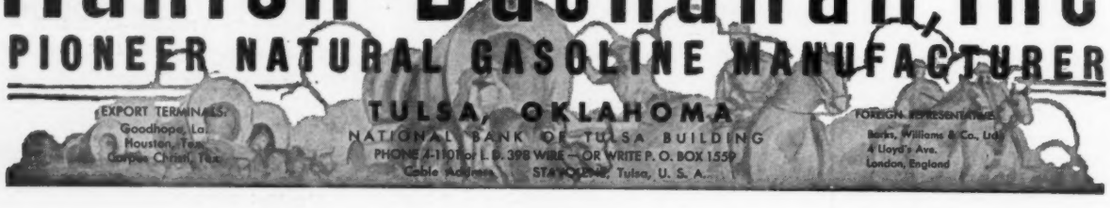

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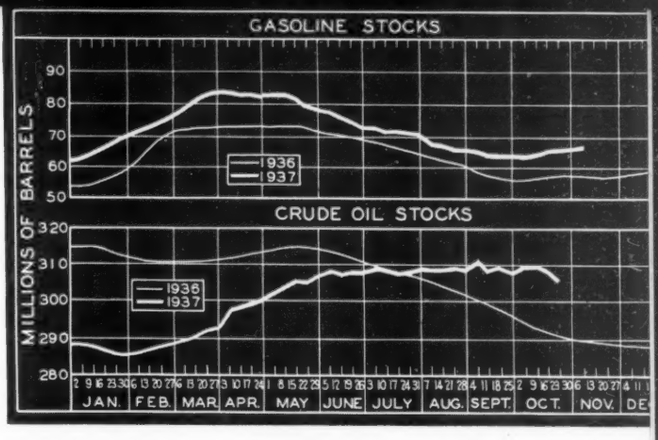


CRUDE oil production in the United States was reduced 79,789 barrels per day in the past week. Oklahoma made a cut of 4,350 barrels; Texas, 46,700 barrels; California, 8,200 barrels; Kansas, 11,375 barrels, and Louisiana, 8,365 barrels. This brought production down to where it was in mid-July when it began its climb to the peak of 3,735,393 barrels per day reached late in August.

CRUDE PRODUCTION *3,537,203 barrels daily average—down 79,789 barrels.*

CRUDE STOCKS *306,556,000 barrels as of October 23—down 1,341,000 barrels.*

GASOLINE STOCKS *67,271,000 barrels as of November 6—up 435,000 barrels.*

REFINERY RUNS *3,325,000 barrels daily week of November 6—down 20,000.*

Another favorable sign was the fact that the Bureau of Mines' latest available report on crude oil stocks showed a withdrawal from storage of 1,341,000 barrels in the week ending October 23, an average of 191,571 barrels per day.

On the other hand the downward trend in gasoline tankcar price continues. Standard Oil Company (Indiana) reduced gasoline tank-wagon and posted dealer prices .3 cent effective in 10 states of the Middle West. This is the first reduction in that area since last June when prices were reduced one-half cent. In the adjoining state of Ohio, Standard Oil Company of Ohio reduced gasoline tankcar, tank-wagon and dealer prices one-half cent. Standard Oil Company of Nebraska made a reduction of .3 cent in Nebraska.

These reductions are a reflection of the general weakness in gasoline tankcar markets which has been apparent over a large part of the United States for several weeks. In the Mid-Continent, the key Oklahoma (Group 3) open market quotations have declined one-eighth cent a week and are now one-half to five-eighths cent under the prices prevailing at the end of the summer.

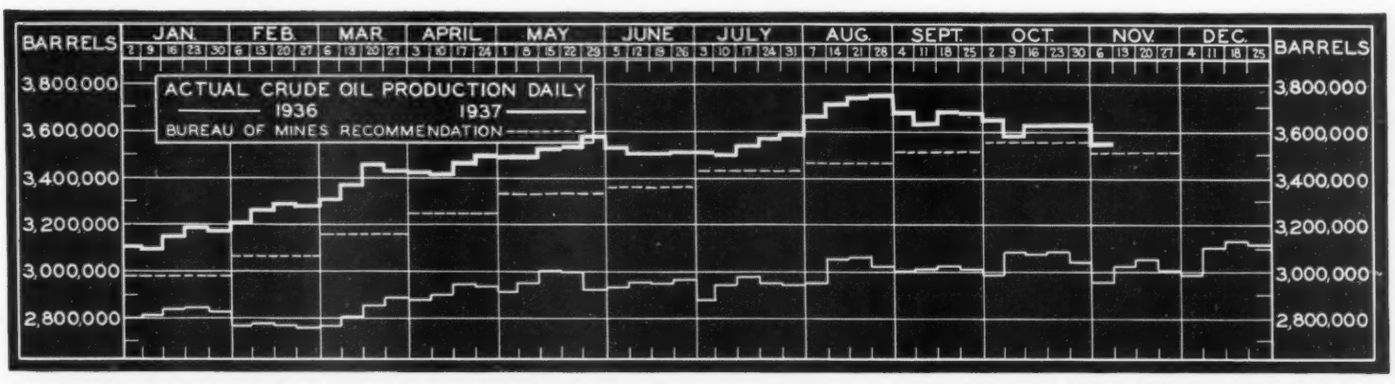
The lower gasoline prices have caused a few plants to be shut down in the Mid-Continent. A report completed the first of the week indicated that crude runs to stills at Mid-Continent refineries are approximately 30,000 barrels daily less than last month. Residual fuel demand has fallen off with the lubricating oil markets generally weak. Those familiar with conditions believe that the refinery market situation will improve provided the present favorable position of crude oil supply and demand continues over the remainder of the year.

The most important event in the producing division in the past week was the discovery of large production northwest of the Greeley field in Kern County, California, where a well at a total depth of 11,302 feet flowed 1,340 barrels of 39-gravity oil in 24 hours through an eighth-inch orifice. The well is estimated as high as 10,000 barrels a day on open flow production. It is the deepest producer in the state. Operators in the old K.M.A. field in Wichita County, Texas, believe the deep sand development in that field will cover an area of 45 square miles.

Daily Average Production for Week

	Nov. 6 1937	Bur. Mines Nov. est.	Nov. state allowables	Oct. 30 1937
Oklahoma City	147,325	.....	.....	141,150
Fitts	69,650	.....	.....	79,250
Remainder of state	365,400	.....	.....	366,325
Total Oklahoma	582,375	598,000	575,000	586,725
East Texas	484,897	.....	.....	485,947
West Texas	206,547	.....	.....	217,350
North Central Texas	108,250	.....	.....	107,898
Texas Panhandle	67,100	.....	.....	79,000
East Central Texas	109,698	.....	.....	110,200
Gulf Coast Texas	338,550	.....	.....	350,000
Southwest Texas	112,050	.....	.....	123,397
Total Texas	1,427,092	1,413,300	1,386,949	1,473,792
North Louisiana	68,400	.....	.....	76,265
Gulf Coast Louisiana	167,250	.....	.....	167,750
Total Louisiana	235,650	246,200	253,150	244,015
California	692,200	674,600	674,600	700,400
Kansas	174,225	189,700	180,215	185,600
Arkansas	47,775	33,100	.....	48,641
Eastern fields	131,500	124,000	.....	135,200
Michigan	55,146	47,400	.....	54,319
New Mexico	104,860	104,800	104,800	104,030
Rocky Mountain area	86,380	77,900	.....	84,270
Total United States	3,537,203	3,509,000	.....	3,616,992

Decrease, 79,789 bbls. daily.



SPARKS FROM THE NEWS

RELATIVITY

The statement of a research enthusiast that a gallon of "straightrun" gasoline contains hydrocarbons worth $50 is no consolation to a skimming plant operator who right now is having difficulty getting 4¼ cents for the same gallon.

OIL ON WATER

Oil may be poured on the troubled waters of the Duke of Windsor. A Canadian government report says prospects are good for the discovery of oil on the Duke's big ranch.

NEXT!

The large reduction last week brings crude production down to approximately the same levels as early July when the large weekly gains started. The immediate need is for refinery crude runs to show the same decline.

RARE

One of the few occasions when an oil man won over a banker is reported from East Texas. At Kilgore a bank was forced to move to make room for an oil derrick.

TWO DIMENSIONS

It's a long time and a long way from Colonel Drake's 69½-foot, 30-barrel well near Titusville to Union Oil Company's 6,000- to 10,000-barrel, 11,302-foot well in Kern River, California. It represents 78 years of exploration as well as 3,000 miles.

POTENTIAL

A very good geologist has expressed the opinion that a large deposit of oil lies buried near the Hugoton gas field in Kansas.

RESERVES

An area in Oklahoma larger than the present oil-producing region remains open for exploration. Gulf Coast and California operators are accustomed to wells 2 miles deep, but they are still a novelty in Oklahoma and Kansas.

PERSISTENCY

W. W. Silk, veteran Wichita Falls, Tex., operator, has stressed the deep-pay possibilities for many years. The new production in the K.M.A. field is in part due to his persistency.

RAILS PROFIT

Despite the increased use of pipe lines for the transportation of crude and refined oil products, the class 1 railroads collected more money for the transportation of oil last year than in any previous year. The amount approximated one-quarter billion dollars.

KANSAS ACTIVITY

If the current rate of discoveries in Kansas continues, the Corporation Commission will have to install a new adding-machine department to tabulate the number of oil and gas pools in the state.

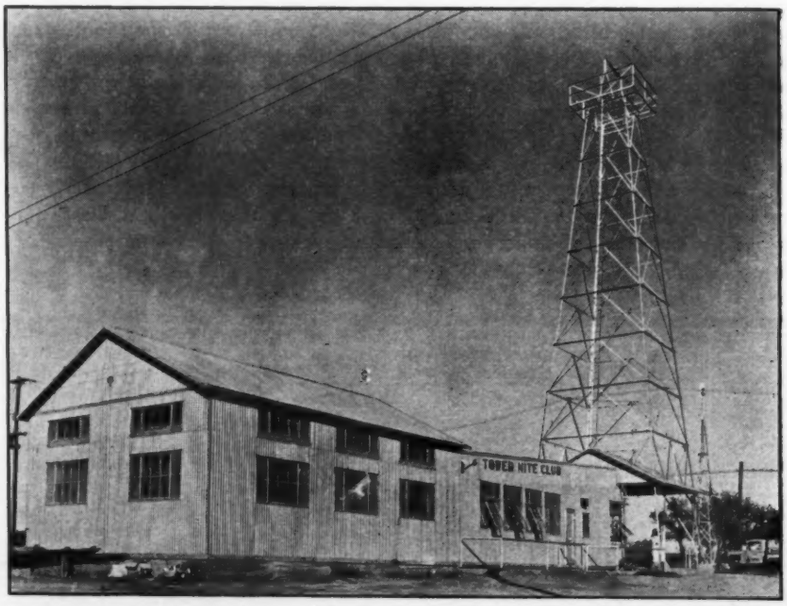
FACTS

President Byles suggests that outside critics read the Cole committee report to congress. Many oil men do not realize what a strong case that particular investigation made for the oil business.

GASOLINE CONSUMERS

An electrical manufacturer reports that 30 per cent of its employes now drive to work, compared with less than 12 per cent in 1929. This trend explains in part the large gains in motor fuel consumption in industrial centers over the past three years.

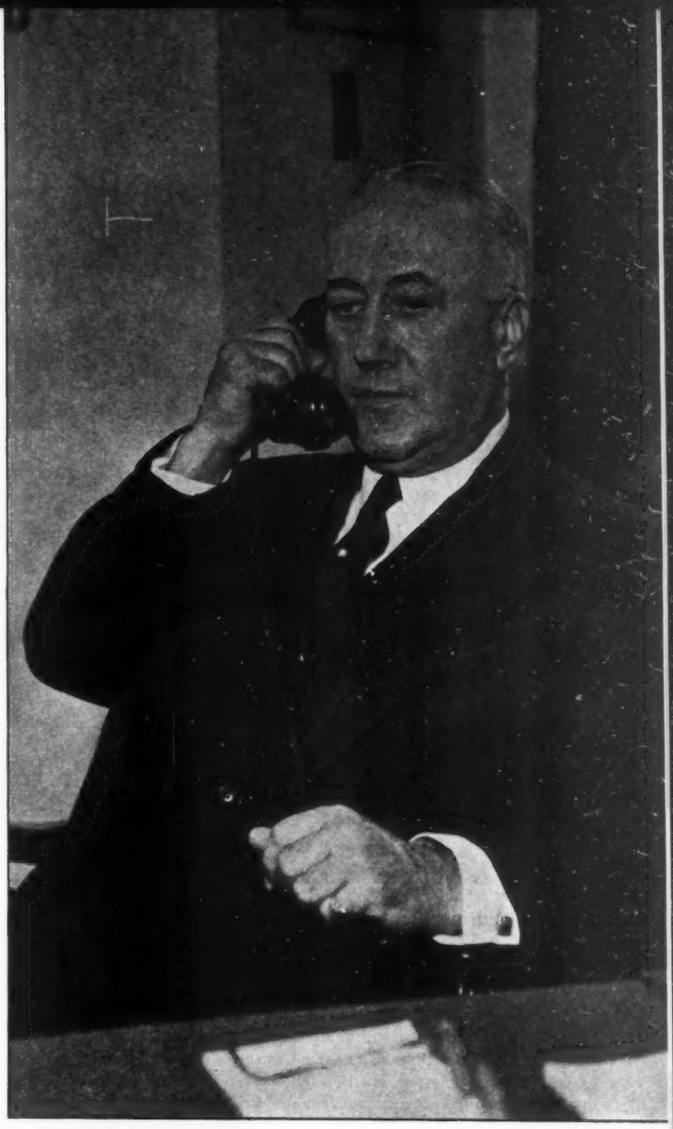
YOU'RE WRONG—IT'S A FILLING STATION



An Oklahoma retail station operator reproduces pumping unit to house a four-pump service station and amusement center. The buildings consist of sectional steel engine-house and belt-house with a standard 84-foot pumping derrick

Industry Must Help Public to Understand

By AXTELL J. BYLES
President, American Petroleum Institute*



President Byles thinks it over

In these days when many uncomplimentary things are being said about American industry, it might be permissible, upon this occasion, for one to say that you gentlemen are rendering increasingly commendable public service. This is so when measured by quality, quantity, price and distribution of your products, wages and working conditions of employes and, during the past year, an approach toward a more reasonable return on invested capital, notwithstanding increasing costs of finding and producing petroleum from deeper levels and increased cost of materials and supplies. A larger volume of business has been a major factor in this achievement, but equally important has been the efficient application of science, invention and improvement in the technological arts. Likewise, upon this occasion, it may not be amiss to draw attention to the fact that this industry, in good times and bad, has not only met every public obligation without asking for financial aid from the taxpayer, but is, upon the other hand, contributing to the support of government in the form of taxes upon its properties, products and operations at the staggering rate of $1,181,000,000 per annum. This tax bill is but slightly less than the $1,373,000,000 which the industry pays to labor and four times the amount paid to the large number of persons who furnish the capital required.

The oil producing states and their conservation authorities are increasingly seeing to it that the industry recovers the greatest number of barrels per acre at the least cost. The federal congress has supported the state authorities in this conservation program through readoption of the Interstate Compact and the Connally act. The department of the interior is furnishing estimates of consumer demand which enables the industry to plan its operations to meet this demand in the most efficient way. The industry is appreciative of and supports this policy of government.

The public should be appreciative of these services and would be if it understood them. The critic and the vendor of panaceas is ever heard in the land and there are those who quite understandably feel the pinch of changing economic conditions in this, as in other industries, and do not subscribe to the doctrine which should be the charter of every business, namely that the public interest is paramount and that it is entitled to receive the most for the least for the longest time. That the public may receive this, business must receive enough to give labor reasonable wages and good working conditions and capital a reasonable return as an incentive to investment, and in the petroleum business the raw material must be produced in such a way as to avoid waste of reservoir energy, transported at low cost, refined with increasing efficiency and distributed widely and cheaply.

Before turning to other matters I wish briefly to review the economic and inventory situation as of September 30, which marks the end of the high gasoline consuming season, and to forecast what we conceive to be an economic program for the following six months, subject to revision as developing circumstances may indicate.

On September 30, 1936, there were 57,800,000 bbls. of gasoline in storage which included a surplus of possibly 3,000,000 to 5,000,000 bbls., and on March 31, 1937, 81,651,000 bbls. Calculations, based upon the anticipated demand for motor fuel during the year which ended September 30 last, and which since have proved substantially correct, indicated minimum requirements at the end of March of this year to have been 74,000,000 bbls., and at the end of September 57,000,000 bbls. When the final figures are in they will probably show that about 65,000,000 bbls. were in storage on September 30, last. It would therefore appear that whatever surplus actually existed on September 30, 1936, was added during the winter of 1936-37 and that very little, if any, progress was made toward its liquidation during the summer just closed.

Estimated Demand

Calculations recently made of the estimated economic demand for motor fuel in 1938 show minimum requirements of gasoline inventories as of March 31 next to be approximately 80,000,000 bbls. Should a major business recession during 1938 occur, this inventory would be too high.

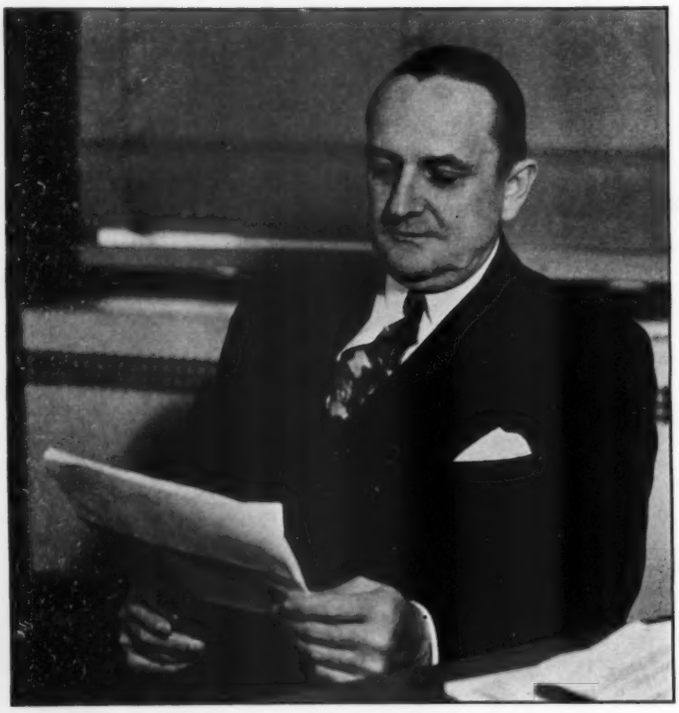
During the winter season of 1935-1936 more than 23,000,000 bbls. of gasoline were added to storage and during last winter the additions amounted to about 24,000,000 bbls. Should the coming winter prove an unusually severe one the economic gasoline situation next spring will not be comfortable if overproduction of crude oil presses on the refiner during the winter and if the refining branch of the industry fails to handle runs to stills in such a way as to meet the heating oil demand without glutting the gasoline market.

Economically it would appear that an average daily crude oil production of 3,500,000 bbls., in the country as a whole, for the six months commencing October 1 last, a decrease, in the area east of California, of one-half of 1 per cent in the gasoline yields established last winter, and an increase of the same per cent in the distillate yields established during that period, would bring the industry, economically speaking, into a relatively satisfactory gasoline inventory situation on March 31 next.

These references are, of course, understood to be a discussion of the economics of the situation and without knowledge other than that common to all. When one suggests a slightly decreased yield of gasoline per barrel of crude run, even for the winter season, it sounds like retrogression. As a practical matter, however, distillates for heating purposes have become a major product to which the public is entitled. The refining branch of the industry has made such remarkable progress in recent years that it is not subject to just criticism by any one. This branch might, however, well consider cutting deeper into heavy fuel in order to aid in supplying the distillate market, thus conserving, so far as is practically possible, the largest potential of gasoline recovery. This would be of economic assistance to the coal industry, but an attempt to aid that industry by imposing a penalty tax on heating oil would be unfair to the consumer of that product and justly arouse his indignant opposition.

For many months we have been exporting both as crude oil and refined products more than 100,000 bbls. per day above normal requirements. This is undoubtedly due to so-called undeclared wars and to fears of war. The size or duration of this market is unpredictable. Furthermore, if we translate our present excess gasoline stocks back into crude oil, our inventories of the latter commodity on October 1 would have read 327,000,000 bbls. instead

*Before A.P.I. eighteenth annual meeting, Chicago.



A.P.I. Executive Vice President W. R. Boyd, Jr., at his morning mail

of 310,000,000 bbls., as compared with 288,000,000 bbls. on January 1 of this year.

In considering the important problem of its public relations, the petroleum industry may as well recognize the fact that in so far as the production of petroleum is concerned, if it goes, or is driven back to the old rule of capture, uncontrolled by proration in fields which must be prorated to prevent waste of reservoir energy or excess of above-ground storage, it will be indicted in the court of public opinion, and not long remain a free enterprise. On the other hand, it must also recognize the fact that by following sound practices of conservation, it may be charged with solely desiring to maintain prices by those who, no matter how sincerely, nevertheless erroneously, believe themselves to be hurt by orderly production and conservation.

The industry may also as well recognize the fact that some people believe territorial uniformity in gasoline prices results from a conspiracy to bring this about, while others charge variances in these retail prices to a conspiracy to destroy competition. While the easy way would be to dismiss these suggestions by drawing the obvious conclusion that we are "damned if we do and damned if we don't," such a treatment of the subject will not do.

The price of gasoline is displayed at every retail outlet. If, due to any cause, a price reduction is posted in gasoline of generally comparable quality, all dealers in the vicinity must follow the reduction or lose their business in this highly mobile market. In other lines such practices are referred to as competition. In the oil business they are referred to as price wars. This difference is largely due to the fact that uniformity or variance in gasoline prices are ever kept before the public, while in many other lines of merchandising as great uniformity or much greater variances occur without the public being generally aware of them.

When conditions warrant, and a large retailer has the courage to mark up his price, competitors follow with the commendable desire of also improving their profit situation. If basic conditions do not justify the increased retail price, it is neither followed nor long maintained.

The market for petroleum products goes up or down as that for other commodities, being affected by general and local conditions, but most of all affected by the law of supply and demand. As in the case of hogs or corn, if too much goes on the market, prices recede; if too little, prices go up. The fact is that as a result of abundance and ever-increasing operating efficiency and the keenest kind of competition, gasoline prices have declined in an almost unbroken curve to about half what they were in 1920. "Gasoline is cheap, only the tax is high."

A comparison of the average hourly wages paid by an efficient refinery of fair size in 1920 with those paid in 1937, expressed in terms of gasoline purchasing power (not including the tax), shows that the refinery worker could buy in 1920 slightly over 2 gallons of gasoline with an hour's wage, while in 1937 he is able to purchase about 6½ gallons of gasoline with his hour's wage. It is my belief that this ratio prevails in approximately three-quarters of the refining capacity of the country. This furnishes not only an interesting illustration of the distribution of wealth by the petroleum industry but also illustrates the trend of wages paid by the industry in comparison with the price charged for its principal product.

As a result of the abuses of the fixed margin or guaranteed profit system in the marketing of gasoline, the imposition of chain store taxes and other burdensome legislation, the manufacturers have very largely withdrawn from retail marketing. This branch of the business is therefore going through a period of transition which should eventually put it on the same basis as any other merchandising operation.

Probably over 80 per cent of petroleum products are sold by independent merchants. It is hoped and believed that the vast majority of these merchants, who conduct their operations in a businesslike way and for whose facilities there is a public demand, are as prosperous as the good merchandiser in any other line of business. I believe that the millions of motorists who enjoy the remarkable service rendered by the distributors of petroleum products concur in the opinion that these merchants deserve to be successful.

Current events, however, indicate that a small minority who for one reason or another are unsuccessful or dissatisfied have turned not only upon their suppliers but are appealing to the government for laws or regulations which they believe will improve their situation, saying, "There ought to be regulation," instead of, as in the old days, "There ought to be a law," having recognized, through bitter experience, that just the enactment of a law and yet another law will not help the situation but believing that if some governmental agency is given the power of regulation and yet more regulation, the millenium will be achieved.

It is noteworthy that suggestions for governmental regulation do not come from the consumers of petroleum products and, in view of the prices they are paying and the service received, this is quite understandable.

These suggestions range all the way from state licensing of filling stations, compulsory price-posting and minimum price maintenance to the disintegration of operating companies, the striking down of the state and federal petroleum conservation laws and the abolishment of the statistical service rendered by the Bureau of Mines.

Periodical Investigations

The industry has periodically been investigated by congressional committees. The last of these was by the Cole committee and was very constructive by reason of the character and caliber of its members, the thoroughness and impartiality of its work and the cooperation of all branches and interests in the industry. Other investigators, both state and federal, might study the 3,000 pages of testimony taken, over a period of six months, by the Cole committee, thus saving considerable of their time, large public expense and permitting the industry to devote more of its time and energy to the business of serving the public.

We are now facing what may prove to be a series of investigations by state authorities. It is well to bear in mind that these investigations do not just happen. They frequently result from the complaint of someone who feels aggrieved. The industry should prepare for these inquiries in the same cooperative spirit and with the same frankness and thoroughness with which it met the Cole committee. It has nothing to conceal and may get a substantial return through this means of informing the public, as well as the state authorities, of the operations of this business, concerning which the public is too little informed and far too much misinformed.

We will not here review the necessity of the conservation laws for the protection of the public interest, but we might inquire, for example, how

(Continued on Page 94)

15 Minutes With the A.P.I.

If you are too busy now to read the numerous papers and addresses presented at the 18th Annual Meeting of the American Petroleum Institute (many of them published in this issue), turn to pages 98, 99, and 100, where The Oil and Gas Journal's staff men give you the high spots in convenient form.

The Journal editorial representatives at the Chicago meeting this week are: C. O. Willson, Editor; W. T. Ziegenhain, Engineering Editor; Dr. C. K. Francis, Technical Editor; L. G. E. Bignell, Production Engineering Editor.

New Deep Field in California With Possibility of Another

By L. P. STOCKMAN

LOS ANGELES, Calif., Nov. 8.—A new light oil field has been discovered by Union Oil Co. about 5 miles northeast of Rio Bravo in Kern County and Ohio Oil Co. is expected to prove a new field a few miles northwest of the Ten Section field within a few weeks.

Union's discovery, No. 1-34 Kern County land, in section 34-28-25, also has the distinction of being the deepest producer in the state as it is flowing 1,340 bbls. of 39.4-gravity oil daily from 11,302 feet. On a one-hour flow test the well indicated a potential daily production of 6,000 bbls. and field men watching the test were of opinion the well's production would exceed 10,000 bbls. per day if opened up. At present it is flowing through an 8/64-inch bean and shows a tubing pressure of 1,950 pounds and a casing pressure of 2,000 pounds.

The well came in without being swabbed and it was only with the greatest care it was kept under control. Superior Oil Co. has extensive holdings immediately adjoining the discovery and tentative plans have already been made to begin immediate drilling of an offset. Union Oil Co. has started laying a new pipe line from the well to its Rio Bravo pump station and this 5-mile link should be completed within 48 hours as rush orders have been issued.

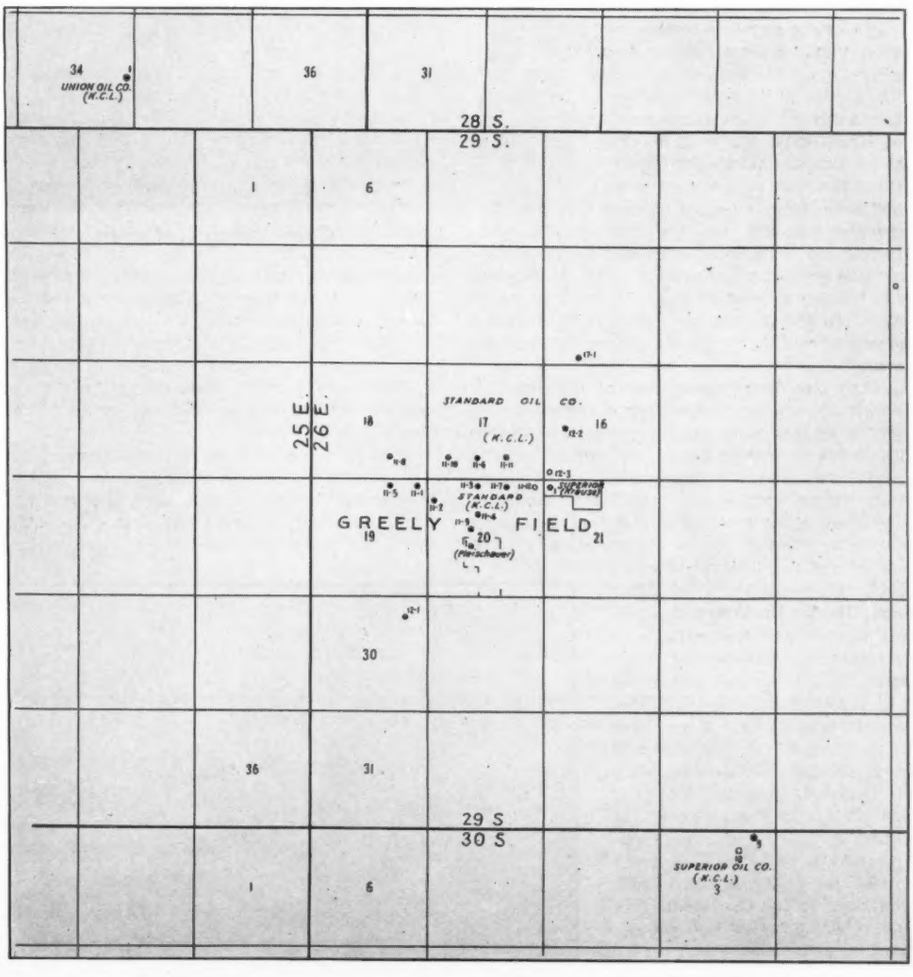
Completion of this wildcat is one of the most important developments in the San Joaquin Basin since Shell Oil Co. stepped out into the center of the basin and discovered the Ten Section field, as the new well indicates that deeper production may be expected in both the Ten Section and Greeley fields. The Stevens sand was barren in No. 1-34 but the company continued drilling and found the Vedder horizon productive. Union Oil Co. is not concerned because of the depth as its field department is of opinion new wells in this field can be drilled for less than $100,000 after the coring points have been determined.

In addition to discovering a new oil field the new producer confirms the expressed belief of geologists that several additional fields should be discovered along the line of folding extending from Greeley to Semi-Tropic and from Ten Section to Buttonwillow. These two parallel lines of folding are of paramount importance and we may anticipate the starting of several new wildcats along these trends in the immediate future.

The discovery has greatly increased the future reserves of California not only because the new Vedder zone will probably be found productive in both the Ten Section and Greeley fields but also because of the probable discovery of a new field northwest of the Ten Section field by Ohio Oil Co. and another southeast of the Greeley field by Superior Oil Co. All of these areas were discovered as a result of geophysical surveys by reflection seismographs and thus for the first time this type of exploration has proved exceptionally prolific in California. Early work along this line in California a few years ago was not especially favorable but with improved equipment and a high-type of employes geophysical exploration has become a necessary adjunct in California exploration. The Union discovery is producing from rocks of Miocene age and thus all fields along the two parallel trends extending from the Greeley oil field to the Semi-Tropic gas field and from the Ten Section oil field to the Buttonwillow gas field may contain oil and gas in commercial quantities in underlying rocks of Eocene age. Top of the Eocene in the new Rio Bravo field is tentatively placed at approximately 16,000 feet. This depth appears to be out of reach at present but 10,000 feet looked just as far away a few years ago.

California prospectors are obliged to discover approximately 200,000,000 bbls. of production annually to keep pace with demand but in view of the new reserves disclosed within the past two years the decline factor has been taken care of for several years. In the Strand area of Kern County, a few miles northwest of the Ten Section field, Ohio Oil Co. is preparing to land casing for a test of No. 3-E Kern County Land in section 14-30-25. This wildcat is bottomed at 8,129 feet in an oil sand topped at 8,095 feet and a formation test made several years ago indicated a potential of 2,000 bbls. of 34.6-gravity and 15,000,000 feet of gas. The tester was open for one hour and the test was so conclusive there is little doubt Ohio Oil Co. has discovered a new productive interval along the Ten Section to Buttonwillow line of folding. This wildcat is about 3 miles northwest of the Shell discovery well in the Ten Section field. There is practically no land available along the two lines of folding between Greeley and Semi-Tropic and Ten Section and Buttonwillow as this acreage has been tied up solid for several years.

It is probable deep drilling will become an important factor in California during 1938 and for a number of years. This is especially true out in the center of the San Joaquin Basin which contains several thousand feet of Pliocene, Miocene and Eocene formations and may prove true also in several fields of Los Angeles Basin.



New pools, or northwest and southeast extensions to Greeley field

K-M-A Field Hailed as Largest Opened in North Texas Area

By L. E. BREDBERG

FORT WORTH, Tex., Nov. 8.—The K-M-A or Kemp City field in southern Wichita County, is being referred to by scouts, operators and company men, as the largest ever opened in the North Texas district. A field is already claimed for at least 7 miles east to west and about 5½ miles north to south, with only one direction, the southwestern, being so far defined, and extensions being made from time to time.

Geologists are divided as to from what formation the oil is being produced, some saying Bend whereas others are just as firm in believing it is Strawn, with no other deep production being found in the district in the same horizon although deep tests have been drilled in the old Burkburnett, Northwest and Electra fields, nearest fields to this one, those tests proving failures.

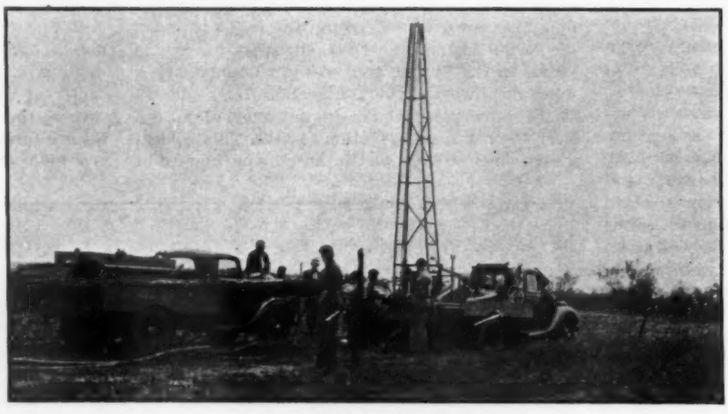
The deep pay was uncovered, May, 1931, by Deep Oil Development Co. on the Munger farm, in the Kemp Wichita Valley Farm Lands Survey, about a mile north of Kemp City, the well making about 125 bbls. initial production. Until the first of last year little had been done in regard to deep drilling, although the Deep Oil Development Co. was organized for this specific purpose by a group of operators and bankers in Wichita Falls. It was then headed by N. H. Martin, but at present J. T. Harrel is president and J. W. Thomas, vice president and manager.

Only five deep producers were in the field in March, 1935, when steady deep development was started by this company. Since that time 44 deep producers have been drilled, 36 are now drilling, with a number ready for completing, and around 20 new rigs ready to start up. Large extensions and good wells are responsible for the present flurry in leasing and development, a 4½-mile northeastern extension being made last week by W. H. Hammon, Hanlon-Buchanan, Inc., on the Fassett and Tuttle lands in section 1, E.T.R.R. Survey, north of the river. The well topped the lime at 3,847 feet and the saturated lime at 4,002-03 feet. It was shot in sand from 3,998-4,014 feet and made 150 bbls. the first hour after cleaning out. Total depth is 4,018 feet. This is the first producer and extension north of the river, and there is no telling how much farther the field will run in that direction, or for that matter, in any other direction not yet defined.

It was also extended northwest last week when Melat & Graham No. 1 J. & J. Waggoner, another well north of the river, was shot in the sand, but bridged, showing sufficient oil to prove it a producer however, and another big extension. The sand was topped at 3,840 feet.

Eastern Extension

A 3-mile eastern extension was drilled by Clyde-Texan Oil Co. on the A. Burnside lands, and the well shot in sand from 3,923-54 feet before completing. It was put on pump, gauge not yet reported. This test is in the J. M. Sharp Survey and proved a large acreage.



Core drilling shot wells

On the west side, Jack Kadane is preparing to drill plug on No. 1 C. A. Mangold, in Block 38, P. Castleman Survey. This may make the first western extension. It logged sand from 3,700-05 feet.

The field was opened to production in 1919, shallow sands paying off from that time until the present, producing from 450, 1,200, 1,650 and 1,750 feet, the majority from the 1,650-foot horizon. Two wells are being pumped by windmills, making around 8 bbls. per day, the pay not known as they were previously drilled deep and abandoned, the owner later rigging a windmill over the holes, running rods and tubing and pumping them himself. They are both on the Burnside farm on the eastern side of the field.

The deep wells are being drilled mostly by rotary to the Big lime around 3,620-3,700 feet. Pipe is set here. They are then deepened by cable tools, and the sand given a shot, varying from 200 to 500 quarts. They are then cleaned out, 2- and 2½-inch tubing run, and then put on production, the entire drilling and cleaning out taking from 25 to 30 days and the wells costing from $21,000 to $25,000. Acid is not used in treating the formation, which is oolitic lime, sand and cherty Conglomerate.

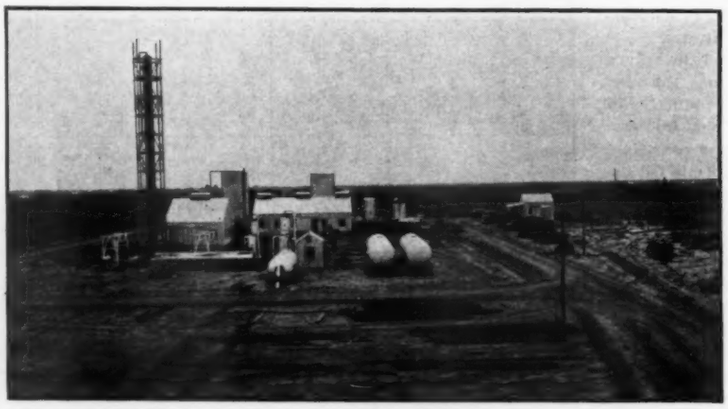
In shooting, around 200 feet of chat is run in on top of the shot and the hole filled with oil to better control the well after the shot is detonated and while cleaning out, this holding down the pressure.

Some wells are not shot and some are merely pumpers, but the greater majority are flowing wells, especially those completed recently. There is one plant repressuring the shallow sands, but Deep Oil Development Co. is erecting a repressuring and gasoline plant on its Munger (discovery) lease to extract gasoline and use the residue for repressuring. This plant will have a daily capacity of 1,500,000 feet of gas. The W. H. Hammon plant is recycling from 3,000,000 to 4,000,000 feet of gas per month through its plant into the shallow wells. Gas is used for fuel, gas engines and steam being used for power in drilling.

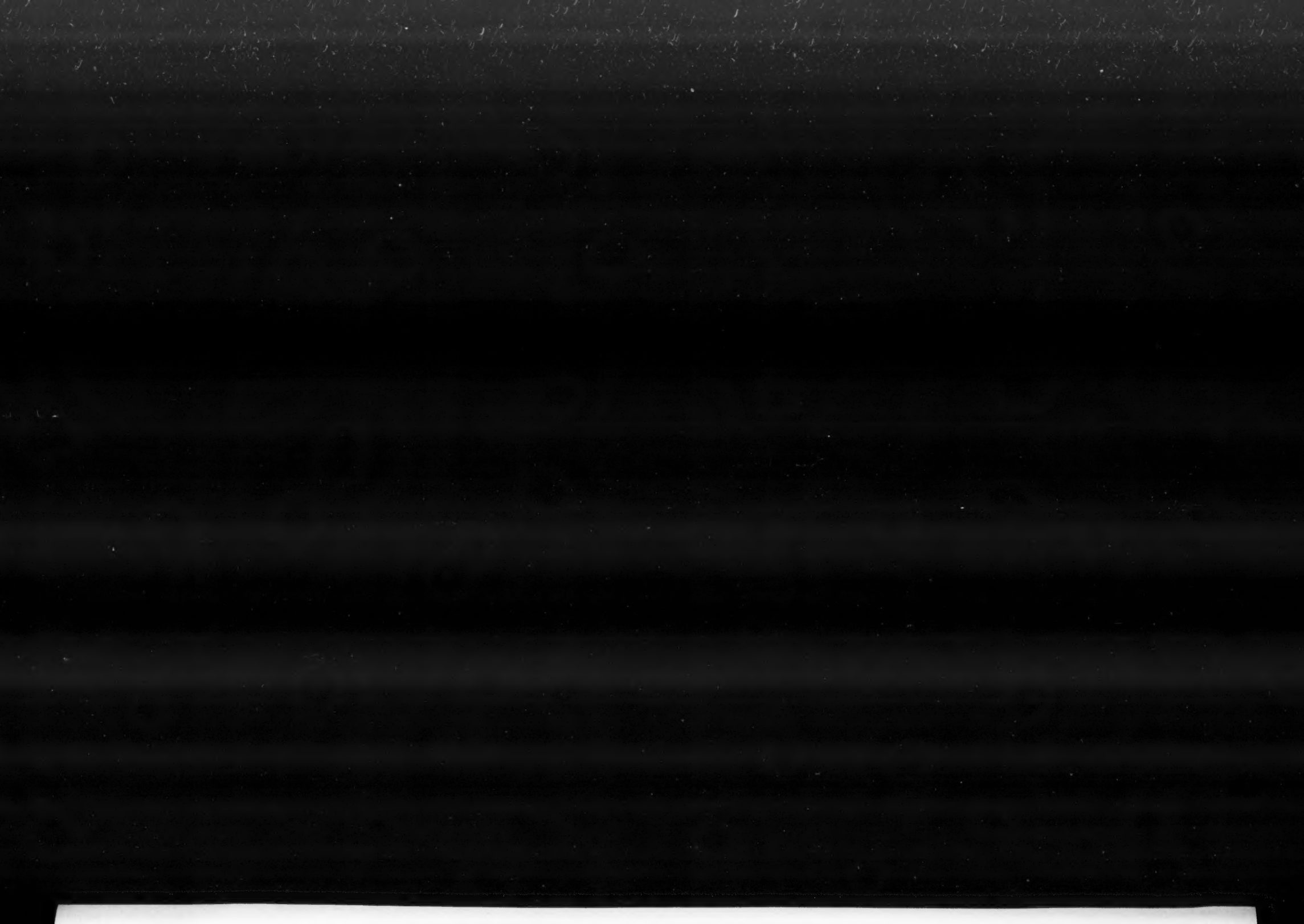
The field is about 22 miles northeast of Wichita Falls. It is served by five major pipe lines: Texas Pipe Line Co.; Sinclair Refining, pipe line division; Continental Oil Co. (which runs the oil to its refinery at Wichita Falls); Gulf Refining Co. pipe line division, and Magnolia Pipe Line Co. The maximum daily allowable for each well is 68 bbls., cut from 106 bbls. November 1, wells being prorated on a potential-percentage basis. The oil tests 42.0 degrees, the gas having a high gasoline content, but wells not having high gas volumes.

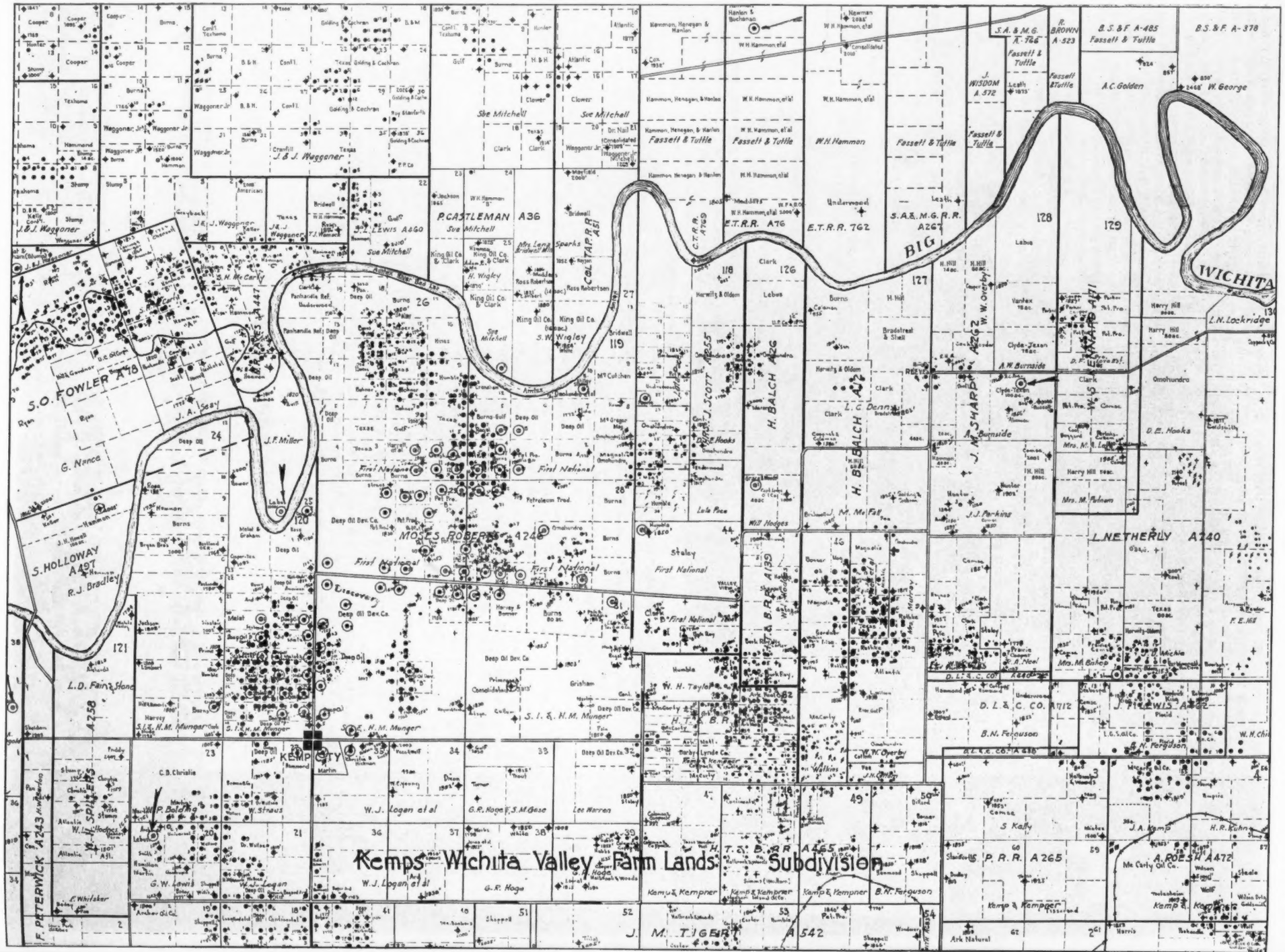
One well is allowed to each 10 acres, and with the acreage already proved and being extended, several hundred wells may be drilled. If all of the area proves productive it will cover 45 square miles.

(Map of area on opposite page.)



Repressuring plant




Kemps Wichita Valley Farm Lands Subdivision
KEMP CITY
S.O. FOWLER A 78
S. HOLLOWAY A 497
MOSES ROBERTS 424
P. CASTLEMAN A36
T. & P. R.R. A 465
J. M. TIGERT A 542
P. R.R. A 265
L. NETHERLY A240
BIG WICHITA
J. & J. Waggoner
S. H. McCarty
J. A. Seay
J. F. Miller
G. Nance
R. J. Bradley
L. D. Fair
Sue Mitchell
First National
Deep Oil Dev. Co.
D. L. & C. CO.
B. N. Ferguson
W. J. Logen et al
G. R. Hoge
Kemp & Kempner
J. A. Kemp
H. R. Kuhn
A. ROESH A472
S. Kelly
Ark Natural

Washington May Modify Course to Aid Business

By HENRY D. RALPH

WASHINGTON, D. C., Nov. 8.—The reconvening of congress next week will have greater interest for business than was realized when the special session was called because of the administration's obvious concern with the recession in business activity and its interest in plans for improving conditions in the immediate future.

A very considerable group among the administration's advisors is urging President Roosevelt to modify or postpone plans for social and economic reform which might have further depressing effects and instead to endorse a legislative program which will improve business profits and restore confidence. Since this turn of events coincides with the convening of congress, there is more than normal interest in the message the president will send to congress next Monday and in the attitude expressed by senators and representatives on their return from visits to their home states. If the more conservative and less idealistic among the administration's key men and in congress are successful in dominating the government's course of action this winter, it will have a profound effect upon the president's legislative program.

The wage and hour control bill is technically in a legislative position where it should receive early action by congress, but there are indications it may be sent back to the committee for drastic modifications. Not only are many congressmen from the south and from agricultural regions increasing their opposition to the Black-Connery bill with its provision for a federal board to fix maximum hours and minimum wages, industry by industry, but many other interests are complaining that this bill would increase prices of all manufactured products when there is already increasing consumer resistance to the rising price trend. There is about equal opposition to the proposed new farm program on the ground it would increase cost of food and other agricultural products. This counteraction of forces resisting legislation which might increase the cost of living may result in such a deadlock the administration will have to sanction modification of both the wage-hour and farm bills to allay fears of rising prices which are retarding business activity.

Tax Revision

Evidence that the views of business men are receiving more consideration in congress, if not among administration officials, is seen in the attitude of members of congress toward tax revision. A subcommittee of the house ways and means committee is already at work on preliminary studies looking toward a more or less general revision of the internal revenue laws and has been closeted with treasury tax experts. Proposals of the treasury have not been revealed, but several members of the house committee have expressed their view that tax revision should take the form of aiding business recovery, principally through modification of the 1936 surtax on undistributed corporation income and in the long-standing capital gains and losses tax. This view has been echoed so persistently both by business organizations and influential members of the house and senate that the conclusion is general the administration will have to accept some such changes even though this amounts to an admission the Treasury Department made a serious mistake in pushing through this tax last year in the face of warnings from business men the tax would have the effects which have now become apparent. Evidence is mounting to show that hundreds of business concerns, particularly smaller and medium-sized units, are unable to retain sufficient capital for normal reserves, to pay debts, and to expand because of the operation of the corporation surplus tax, and there is a very general opinion modification of this tax will be an important factor in bringing about the increase in business activity which the administration greatly desires.

The subject of tax allowance for oil depletion has not yet been taken up by the ways and means committee and probably will not be discussed for some weeks. It is not known what the Treasury Department will recommend, but there is no indication the treasury has changed its attitude of last spring when it classified the depletion allowance as a method of tax evasion and a loophole in the revenue laws. While congress declined to amend the depletion provision in the loophole plugging law of the last session, the ways and means committee, indicated the subject might come up in 1938, and Secretary Morganthau last summer renewed his opposition to this allowance and expressed hope it would be altered at the coming session. Likewise, the nuisance taxes, such as the federal excise taxes on gasoline and lubricating oil, have not yet been discussed by the ways and means committee, but will be taken up if the committee pursues its earlier plans of thoroughgoing revision of the entire revenue structure. These taxes were extended until June 30, 1939. Because of the government's need for revenue, there is little thought these excise taxes will be repealed before their expiration date, but there is a general feeling congress should decide whether these taxes should be dropped in 1939 or made a permanent part of the revenue structure.

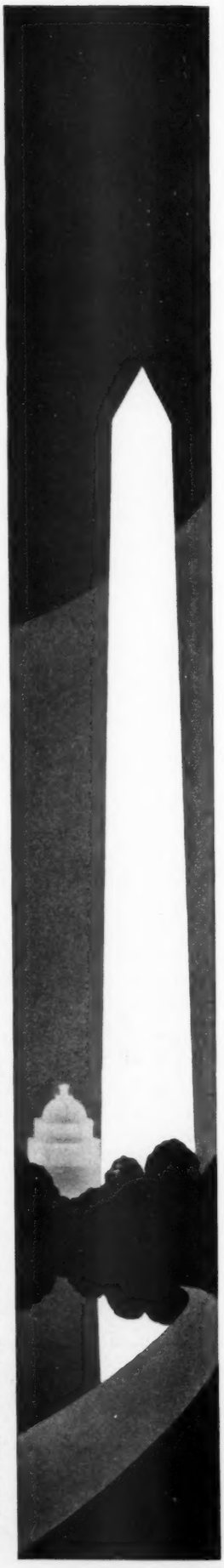
Social Security

Sweeping changes in the social security act are under consideration by the Social Security Advisory Council, composed of 22 citizens not connected with the government, which has been conferring with experts of the Social Security Board with a view to recommending legislation to congress. These proposals include more or less technical changes, but there is also discussion of lowering taxes which at present are scheduled to increase periodically, of preventing the old age fund from growing as rapidly and to as large proportions as the law now contemplates, and of bringing under the act a large number of employes not now covered. It is not probable these recommendations will be submitted to the special session.

A recent ruling of the Internal Revenue Bureau affects oil companies operating barges and harbor craft. The bureau has ruled such vessels as floating pile drivers, mooring scows, barges, and craft of similar type should be classed as vessels and the officers and crews employed when on navigable waters of the United States are exempt from social security taxes.

Freight Rate Increase

A general increase of 15 per cent in all freight rates and charges with a very few exceptions is asked by the Class I railroads in a petition filed with the Interstate Commerce Commission November 6. The only exceptions are coal, lumber, sugar, and perishables, on which the increases would be less than 15 per cent. The railroads asked the increase be added to the increases just granted by the I.C.C. and not yet in effect, including the increase of 1 cent per 100 pounds in rates on petroleum and its products. A similar increase of 15 per cent in all rates is expected to be asked by the major truck lines and possibly also by water carriers, although petitions of these groups have not actually been filed. The commission will not grant the requested increase without an investigation and hearings, but in its recent decisions approving increases on petroleum and other basic commodities indicated it would give favorable consideration to a general raising of the level of all freight rates which would not materially disturb competitive relationships in transportation.



Prosecution Nearing End of Evidence at Madison

By R. B. PYRE

MADISON, Wis., Nov. 9.—Arguments are expected this week on defense motions for dismissal of the government's case in the oil trial. The prosecution announced Monday it probably would complete its evidence Wednesday. Half-day sessions were planned pending completion of computations by government accountants, which will conclude the direct testimony.

Gradual increases in purchases of gasoline by major companies from 1931 on were shown in figures presented Tuesday. Francis B. Hopp, Tulsa, secretary, Skelly Oil Co., testified his company has purchased on the open market for years, even when production was more than sufficient for current sales.

L. S. Wescoat, Chicago, vice president, Pure Oil Co., showed that production, purchases and sales of the company have increased yearly, except for a production decrease in 1934. While his company bought 10,339,350 gallons in East Texas and Mid-Continent in 1934, it purchased 18,906,464 from other refiners and in 1936 bought 16,919,899 gallons from East Texas and Mid-Continent fields while purchasing 23,205,025 gallons elsewhere. It bought 60,000,000 gallons in 1935 and 79,000,000 gallons in 1936 on processing contracts.

Three witnesses were called Monday in the effort to connect officials of Phillips Petroleum Co., Mid-Continent Petroleum Corp. and Continental Oil Co. with the alleged conspiracy.

John H. Lewin, of government counsel, read into the records documents from the files of defendant companies, seeking to support the charge that the purchasing of gasoline in 1935 and 1936 was a "concerted" movement.

The prosecution, temporarily at least, had suspended its attempt to prove that indicted publications knew about the alleged program and gave their cooperation. An apparent interruption in this questioning occurred when the court sustained a defense objection that conversations between two employes of the Oilgram were immaterial. Mr. Chaffetz was reprimanded by the court for "improper conduct" when he slammed a notebook on the table in protest. The reprimand and Chaffetz' apology were later stricken from the record.

E. M. Kelly, Bartlesville, Okla., assistant to the assistant sales manager of the Phillips company, was called as a witness against Frank Phillips, president; F. L. Koopman, vice president; A. M. Hughes, sales manager, and H. A. Gardner, tankcar sales manager. He knew his company made gasoline purchases in the Mid-Continent during 1935, Kelly testified, but did not know of any participation in an "agreement" or "program." The company's production and sales both increased every year from 1933 to 1937, Kelly said, testifying on cross-examination that its jobber trade constitutes an essential outlet. Its sales to jobbers in 1935 were 32.8 per cent of its total, those in 1936 more than 40 per cent, and in 1937 have been 44 per cent. Less than 1 per cent of the jobbers with whom the company dealt have gone out of business in the past five years, he added.

E. McClure Rouzer, of Baltimore, Md., secretary and vice president of Mid-Continent Petroleum Corp., explained the positions of Jacob France, president; Robert W. McDowell, vice president, and Thomas Fitzgerald, assistant to the vice president in charge of sales, all defendants. He identified a letter written by McDowell in April, 1935, to C. S. Smith, Cleveland, Ohio, vice president, National Refining Co., soliciting purchases to "help the market." This letter signed "Bob," read:

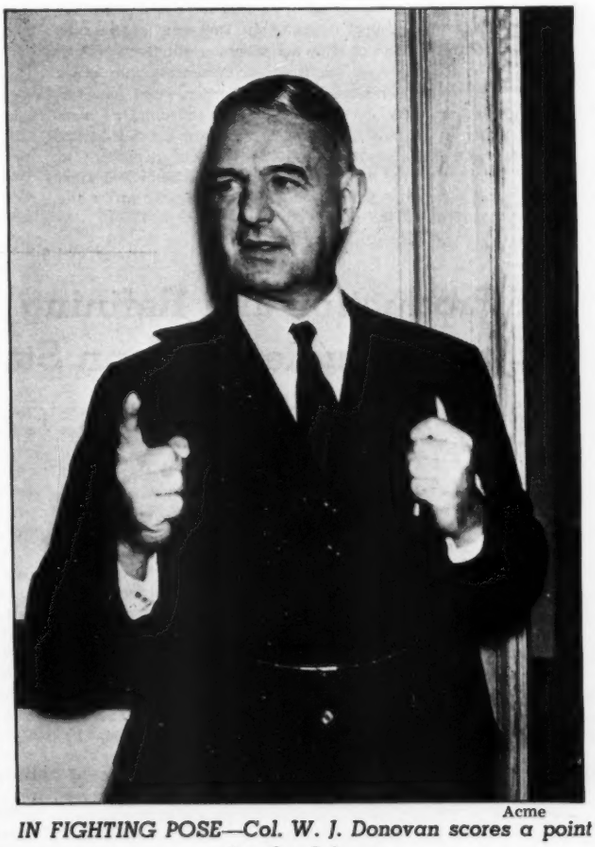
"Dear Charlie:

"I received in today's mail a letter from Harry Kuegler with reference to the possibility of buying some 'Q' gasoline from us, and I have advised him that we would be unable to sell you anything due to decreased allocations, etc., which are forcing us to purchase ourselves, but that I believed I can help him find a satisfactory source.

"What I really have in mind is this. If you people are going to buy, I should like to make some suggestions as to where you can buy so that it might be used to help the market. In fact, I have been thinking about writing you for the past week, soliciting your support to the extent of some regular buying of either 'Q' or third grade, or both. You are conversant with the stabilization efforts that some of us are making along these lines, and it just seems to me that the National Refining Co. should be willing to contribute a little because you are benefiting by the general improvement that has resulted from our efforts."

Chaffetz explained at length, upon inquiry by the court, that "Q" gasoline refers to a product treated to bring it up to specifications of "regular" gasoline. J. C. Denton, counsel for Mid-Continent, suggested he also explain what "allocations" meant.

"I don't mind stating," Chaffetz answered, "that the refinery allocations in that letter are the same allocations we have heard so much about before in this case under the code. The allocating committee told each refiner during the period that the code was in effect how much gasoline each was allowed to produce."



Acme

IN FIGHTING POSE—Col. W. J. Donovan scores a point for the defense

The government called Robert L. Bosworth, New York, assistant secretary of the Continental company, as an identifying witness against Dan Moran, president; H. J. Kennedy, vice president; Edward Karstedt, Kennedy's predecessor, and L. T. Cramer, tankcar buyer, all defendants.

Bosworth, on cross examination, said he recalled no year when the company's production has equaled sales requirements.

"That's the reason, to my knowledge," he explained, "why the company has purchased substantially since 1929 from independent refiners."

The 1935 purchases were slightly less than in 1934, he declared, and 1936 purchases were less than in either of the two preceding years. About 19 per cent of its total purchases in 1934 were made from independents, 17 per cent in 1935 and 14 per cent in 1936.

One document read to the jury Monday was a weekly market letter from the files of the Shell Petroleum Corp., reporting on January 20, 1935, that A. V. Bourque, secretary of the Western Petroleum Refiners Association, was working on a buying program for middle octane gasoline which, it was believed, would make the market move upward on that grade. It contained this penciled notation in the writing of P. E. Lakin, general sales manager: "Think we should participate up to 10 cars."

Others reported a strengthening market and a letter from Lakin to Bourque requested a monthly report on the number of cars purchased by the "buying group."

(Continued on Page 78)

Mexican Government Seizes Land Leased to American Companies

NEW YORK, Nov. 9.—A Mexican presidential decree issued in Mexico City, November 4, nationalizing 350,000 acres of land under oil and gas lease to Standard Oil Co. of California and Richmond Petroleum Co., a subsidiary, gave new cause for concern among American and British companies operating in that country.

Implications of President Lazaro Cardenas' decree are vastly greater than apparent on the surface. His action abrogated one international agreement and overruled a Mexican supreme court decision handed down only last year.

By issuing a decree counter to rulings of the supreme court President Cardenas has raised the possibility similar treatment may be applied to other oil properties. The threat of further confiscation by decree seems imminent since much of the land held by American and British companies is under the same form of oil and gas leases held by Standard of California and Richmond Petroleum Co. Extending even beyond the immediate scope of President Cardenas' decree is the danger that other Central and South American countries may accept the Mexican nationalization program as a precedent. Many Mexican labor regulations have been adopted as guides in other Spanish language countries, although no others have gone to the same extremes.

Although nationalization of Standard of California and Richmond Petroleum Co. 350,000 acres of oil and gas leased land represents practically nothing in actual production the same is by no means true in the case of other American and British companies. Mexican Eagle Oil Co. (El Aguila), Shell subsidiary; Huasteca Petroleum Co., Standard of New Jersey subsidiary; Mexican Gulf Oil Co., subsidiary of Gulf Oil Corp.; Pierce Oil Co., S.A., subsidiary of Consolidated Oil Corp.; the Cities Service units and Continental Oil Co. affiliates are the largest American and British operating companies in Mexico.

Although the U. S. Department of State is expected to make a vigorous protest it was believed in Mexico City that the protest would be fruitless.

Standard of California, which operates in Mexico as California Standard Oil Co. of Mexico, obtained sublease on 100,000 acres from the Mexican Diversified Land Co. The lease from the Mexican government to the land company and the sublease to California Standard of Mexico were confirmed in 1936 by the supreme court.

In nationalizing the land, which is in the southern states of Tabasco and Chiapas, President Cardenas based his decree on Article 27 of the Mexican constitution, making all subsoil wealth the property of the government.

According to the so-called Calve clause written into the organization papers of all foreign companies, all companies organized under Mexican law and recognizing the benefits and liabilities of this procedure are accepted as Mexican companies. Richmond Petroleum Co. was so organized.

Although for months the government has been nationalizing potential oil lands not under lease to foreign or domestic oil companies, this is the first time territory actually under lease has been seized. The move is considered a second step toward the gradual elimination of United States and British oil companies with a capital of $400,000,000 in Mexico. The first step was organization of the National Petroleum Administration "to take over federal oil reserves" last spring. Since that time only a very limited amount of new land has been made available for lease to foreign companies.

The two concerns whose properties were seized had not developed production, but had complied with all exploratory requirements in the leases and in Mexican law to the extent that parts of the 350,000 acres were considered of vast potential value.

THE MARKETS*

CRUDE OIL: *Production was reduced 79,789 bbls. per day, bringing it down to the level it reached last July. Texas, Oklahoma, California, Louisiana and Kansas were responsible for the reduction of output, greatly improving the general crude situation.*

REFINERY: *After giving more ground, gasoline generally believed to have reached bottom. Light heating oils more active, but heavy fuels dull. Lubricant group soft.*

TANK-WAGON AND SERVICE STATION: *Dealer and tank-wagon gasoline prices reduced .3 cent in Standard Oil (Indiana) and Standard Oil Co. of Ohio trade territory and .5 cent in Standard Oil Co. of Nebraska's territory.*

FINANCIAL: *Oil shares, on an average, were weak. Average of 30 representative stocks for week ending November 6: High, 31.55; low, 28.80; close, 29.03. Week ending October 30: High, 32.61; low, 28.14; close, 31.90.*

**Detailed information in Market Section.*

Montana Crude Price Changes

Effective November 1, 1937, Toronto Pipe Line Co. reduced Cut Bank, Mont., crude oil to $1.10 per barrel. On October 25 International Pipe Line Co. made an average reduction of 11 cents per barrel in its prices for Cut Bank crude. Beginning with $1.18 for oil below 35 gravity, it adds 2 cents for each degree upward to, and including, 40 degrees and over at $1.30. Effective October 25, the Ohio Oil Co. reduced its posted price for Kevin-Sunburst crude 15 cents, or to $1.05 per barrel.

Field Strike Ends Pending Negotiations With Company

The five-day strike of Indian Territory Illuminating Oil Co. employes in the Oklahoma City field ended November 8, after a majority of the 600 strikers, as the result of an agreement reached with Governor E. W. Marland, had voted to return to work pending negotiations with the company.

The Oklahoma governor assured the strikers, who had walked out without approval of their union, a C.I.O. affiliate, he would arrange negotiations seeking a settlement over the discharge of 64 employes.

Dial Murphy, chairman of the strikers' grievance committee, said the basis of the present settlement was a promise from the company to meet with the grievance committee and take up individually the cases of the discharged men, none of whom was to return to work pending final settlement. The strikers contended the 64 men were discharged without regard to seniority. Company officials said they would be ready to negotiate after the men returned to work.

Virginia Business Franchise Tax Upheld in Oil Case

WASHINGTON, D. C., Nov. 8.—The Supreme Court upheld the Virginia business franchise tax as applied to total assets of corporation organized in another state seeking to do business in Virginia. The tax was contested by Atlantic Refining Co., which sought to take over Virginia business formerly done by local concerns. The court held the state tax does not impose any unwarranted burdens or prevent the company from doing local business in the state.

Pawnee Agency Announces Sale of Indian Leases

Leases on 24 tracts of Indian lands will be offered for sale November 18 at the Pawnee Indian Agency in Pawnee, Okla., Lem A. Towers, superintendent, announced. The majority of tracts offered are on Kaw Indian lands in Townships 27-4e, 27-5e and 28-3e, Kay County. One Osage Indian tract in section 34-27-4e, Kay County, and one Pawnee Indian tract in section 33-19-5e, Payne County, also are offered.

Texas Supreme Court Ruling On Spacing Significant

HOUSTON, Tex., Nov. 8.—An opinion of possible far-reaching significance was delivered by the state Supreme Court in upholding a permit granted by the Railroad Commission to Century Refining Co. for a well on a 1.6-acre tract in East Texas.

The court held that although this tract resulted from partitioning a larger tract after the spacing rule was in effect, the situation entitled the segregated tract to an additional well.

The opinion pointed out the spacing rule is cast into two distinct parts:

"The first deals with the spacing pattern for the entire field and for wells generally; the second with specific wells, to be drilled as exceptions to the general rule. . . . We interpret their legal effect to be this: An applicant for a permit to drill a well not included within the general terms of the first part of the rule, has the burden of showing a legal right thereto; having secured from the Railroad Commission an order granting a permit to drill, such order when issued is presumptively valid. . . . This presumption casts upon a litigant attacking it in court the burden of proof. Mere proof, as contended for by defendant in error, that the well in question was to be drilled upon a less acreage than 10, did not sufficiently prove the invalidity of the permit in question. . . ."

Production and Refining Problems to Be Studied at Penn State

OIL CITY, Pa., Nov. 8.—Greater attention to economical production of crude oil will be a feature of the Pennsylvania Grade Crude Oil Association's research at the Pennsylvania State College during the coming year. A recent meeting of the directors voted to double its appropriation for this program in 1938. The amount expended by the association, $4,800, will be matched by the state. Thus nearly $10,000, for which the association is directly responsible, will be spent on the projects next year. Money subscribed by Bradford producers for water-flood research, also is matched from state funds. Roughly, some $50,000 in subscriptions and state funds, will be spent in production and research during the two years.

The sums available will make it possible to carry on a comprehensive research program, declared Dr. A. W. Gauger of the School of Mineral Industries. The funds will be used to continue and expand work in air-gas and water-flood recovery methods. The groundwork of the air-gas program has been laid in the work in the Penn State laboratories during the past year and a half. Dr. Harry M. Krutter has perfected analytical methods to where it is expected definite and practical results may be obtained in the next few scientific steps. "This "ground-plowing" has been remarkably successful in the case of water-flood investigations. A recent meeting of Bradford oil men at State College indicated operators have already begun to reap dividends on their investment. The Pennsylvania Grade Crude Oil Association contributes $2,400 annually.

The association's plans for research in the petroleum refining laboratory, at Penn State, next year are significant. This laboratory is headed by Dr. M. R. Fenske and Dr. F. L. Carnahan. During the coming year the staff will spend considerable time on oxidation and sludging of motor oils and crude. Studies in the School of Mineral Industries, made by Doctor Krutter and his associates, indicate definitely loss of gas and oxidation with resultant increased viscosity of the crude have a direct bearing on crude recovery.

"We believe that the coming year's work in the laboratories at State College, together with the results we can expect from the increased advertising, will give the association a well-rounded program," J. E. Moorhead, executive secretary, commented after the meeting of the directors.

the OIL AND GAS JOURNAL

PRODUCING REFINING NATURAL GASOLINE PIPE LINE

Published weekly by The Petroleum Publishing Company at Tulsa, Oklahoma

Enlightening the Public

President Byles, in his address to the American Petroleum Institute, rendered another valuable service to the industry when he emphasized a fact that has been too often overlooked.

"It is noteworthy," he said, "that suggestions for governmental regulation do not come from the consumers of petroleum products. In view of the prices they are paying and the service rendered, this is quite understandable."

When you think about it, these periodic investigations of the oil business, staged as great battles in the public interest, do not spring from any popular uprising over the treatment the public receives from the oil industry. So far from feeling oppressed by gasoline prices the motoring taxpayer can hardly be moved to kick about gasoline tax increases, although they average 30 per cent of what he pays at the filling station.

The instigation of these investigations originates with "a small minority who for one reason or another are unsuccessful or dissatisfied" and who "turn not only upon their suppliers but appeal to the government for laws or regulations they believe will improve their situation."

The public, unable to see through the smoke screen of "championing the people," is easily misled and it was the imperative need for industry to aid the American people in understanding economic, industrial and political issues that was the text of President Byles' address.

"The outcome of these issues depends upon the breadth and depth of public understanding. American industry owes it to America to aid in that understanding."

The oil industry is in a particularly favorable position to do so. It is "rendering increasingly commendable public service, measured by quality, quantity, price and distribution of products, wages and working conditions, notwithstanding increasing costs of finding and producing oil from deeper levels and increased costs of materials and supplies and taxation."

The public would be appreciative of these services if it understood them, President Byles said. If conservation was abandoned and we returned to the old system of wasteful production the industry "would be indicted in the court of public opinion and not long remain a free enterprise." Yet conservation has been attacked as solely desiring to maintain prices.

Some people believe territorial uniformity in gasoline prices results from a conspiracy to bring this about while others "charge variance in retail prices to a conspiracy to destroy competition."

Economic causes which the public, if told, can readily understand, are the answer, not conspiracy.

The oil industry has been investigated time after time; by the Lafollette committee, by the Federal Trade Commission; by the Cole committee. It was placed under the microscope by the Federal Oil Conservation Board during two previous administrations and practically taken over by the Petroleum Administrative Board under the NRA so that its innermost workings must be familiar at Washington. Yet it is now threatened with an epidemic of investigations by state authorities.

To all these President Byles makes the time- and money-saving suggestion that they study the 3,000 pages of testimony resulting from the six months' investigation of the industry by the Cole subcommittee.

The industry, he says, should prepare for these investigations in the same cooperative spirit and with the same frankness and thoroughness with which it met the Cole committee. It has nothing to conceal and may get a substantial return through this means of informing the public of the operations of this business concerning which "the public is too little informed and far too much misinformed."

MADISON

(Continued from Page 75)

A price review for August 23, 1935, reported that interrefinery buying continued to relieve the market, and told of buying in East Texas. A penciled notation said, "Is this part of any plan?"

Attempting to prove that defendant journals published the "seller's" price rather than the "buyer's" price as accessories to the alleged price-fixing conspiracy, the government's attorneys called John Steiger, market checker in the Tulsa office of the Oilgram, but experienced difficulty in employing his grand jury testimony to "refresh his memory," because on repeated occasions he said, "I'm sorry, but really, it doesn't," or "It just doesn't click," and in one instance he said his grand jury testimony was "all wrong."

Doing His Best

Steiger's repeated assurance that "I'll do my best to remember" obviously impressed the court, and Judge Stone cautioned the examiner, John Lewin, to be certain he was "refreshing the memory" and not impeaching the witness, as he was bordering upon "deep water." If he used the grand jury minutes for impeachment purposes, the court warned, the entire transcript would become available to the defense.

On one occasion when Lewin resorted to Steiger's grand jury testimony he received a rebuke from the court, who agreed with defense counsel that Lewin was "putting words in the mouth of the witness."

Lewin's effort was directed to show that Steiger published "seller's" prices without making a thorough check to determine whether the price reported by the seller actually was paid by the buyer.

Most of his information came from sellers, Steiger affirmed, but he also checked with brokers, who are buyers, with Purity Oil Co. of Springfield, Mo., as a jobber buyer, and he received a "double check" on jobber purchases through the Chicago office, he said.

He admitted, however, that "we took the word of the seller usually," as there were few jobbers buying in the open market in "our refinery area." But he insisted the broker prices also constituted a "double check" on jobber prices.

Information came to him from major companies, he said, and he also received the same reports from the East Texas Refiners Marketing Association, from commission buyers such as J. M. Bradshaw of Dallas, and field representatives such as W. P. Jacobi and Neil Buckley.

When the defense objected to questions as to "what Jacobi told you," Lewin told the court the prosecution proposed to prove Steiger "knew these pools were working."

The activity in the field during 1935, Steiger declared, was regarded as a "selling movement" of refiners rather than a "buying movement" by major companies.

The Oilgram did not label the movement as a "buying program," Steiger said, because during the previous year, in 1934, "we had had some buying pools and buying programs."

"I did not ask you about that," Lewin interrupted, but Judge Stone interceded, telling Steiger to "go ahead."

"I think you'd better let him explain it," the court said.

"Well," Steiger continued, "back in those days there were pools and programs in that resources of the companies were pooled together, and out of that central fund gasoline was supposed to be bought. In our mind that was a pool, or a program. It was a highly organized sort of thing and in my way of thinking the lineup in 1935 was different. It was looser, and it was more individualized. The individual companies were buying individually."

Lewin's motion to strike the statement as "unresponsive" was denied.

"I want this jury to get all the information they can with reference to this business," Judge Stone explained. "We are not going to decide this case upon half facts. I think that answer was very competent and very enlightening to me, and I think very enlightening to the jury."

He did not remember ever hearing Jacobi or Buckley refer to the movement as a "program or pool," Steiger declared.

The court's reprimand over use of the grand jury testimony grew out of questioning about a conversation between Steiger and Thomas Fitzgerald, assistant sales manager of the Mid-Continent corporation, in regard to an article for which Steiger was seeking information in December, 1935.

Asked if Fitzgerald told him small independent refiners had been "allotted" to the major companies, Steiger said he did not, nor did he believe he did "in substance." Lewin handed the grand jury transcript to the court. Judge Stone read the passage in question and handed it back.

"There is nothing inconsistent in that," he told Lewin.

It is his recollection now, Steiger said, that Fitzgerald didn't go into "those details," whereupon Lewin showed another excerpt to the judge, who read at considerable length—long questions by Lewin and short answers by Steiger.

When he had finished, Maurice Hanning, counsel for the Oilgram, interceded.

"Now, if your honor please," he protested. "I submit to you, is there anything inconsistent there?"

"No, there isn't," the court answered.

"And it even shows," Hanning added, "the tactics that were used before the grand jury."

It did show, insisted Hammond E. Chaffetz of the prosecution, that Fitzgerald went into some details.

"Well, if you're going to pick out one answer, perhaps it does," the judge replied, "but when you read it all and get the color and shading and the full understanding, there is a different light on it."

Putting Words in His Mouth

But Lewin persisted in attempting to show that Fitzgerald, "in substance," said that there were "allotments" of small refiners, and again showed the court some testimony which again the court held was not inconsistent. Judge Stone finally asked Steiger, "Did Mr. Fitzgerald tell you that?"

"He told us that refiners,—that major companies were buying rather regularly from independent refiners," Steiger replied.

"Now," Lewin went on, "did he tell you that they were allotted, one major company to certain independent refiners under this dancing partner arrangement, or the substance of that?"

"I don't believe he did," Steiger replied, and when Lewin once more resorted to the transcript, Hanning again stepped in.

"I object, your honor," he said, "because it is very evident from what was read out of the grand jury record, that Mr. Lewin was putting words in the witness' mouth."

"It is very apparent that that was done before the grand jury," Judge Stone agreed.

"I submit that it was perfectly proper procedure," Lewin insisted.

"It was very apparent that it was a very leading question, and suggesting the answer you wanted before the grand jury," the judge retorted, adding, when Lewin still sought to argue, "Now, let's have no more discussion on it."

Shortly afterwards, when Lewin's tactics again were challenged, Lewin said he had "no apologies to make" for a "perfectly fair examination before the grand jury," and when the court forbade further discussion on the point, the government attorney persisted, "I am being attacked, and it looks as though I am being tried instead of the major oil companies."

Steiger denied he talked to O. J. Tuttle as to the Empire company's participation in the "program," and said if he testified before the grand jury that he talked to Harry J. Kennedy of Continental, it was because he was "confused," for all his contacts with Continental were through "Mr. Cunningham or Mr. Morris, his assistant."

However, he testified, a conversation with D. K. Chamberlain of Pure Oil was "a specific instance" that stood out in his mind, and Chamberlain told him he was "buying fairly regularly from the East Texas refiners," but as to what Chamberlain said about other major company buying he could not recall.

Later the prosecutor interjected another long excerpt from the grand jury testimony, but Steiger said he was "certainly mixed up" when he gave it.

Testimony a "Buildup"

Steiger said there was no need of refreshing his memory as to his grand jury testimony, as he had gone back and checked the prices indicated in his market leads, "and I don't believe there was a time when the major company buying prices were higher than the Oilgram prices."

"I would like to have a chance to explain that," he said, and the court directed him to "go ahead."

"Well, in the first place," Steiger proceeded, "that grand jury testimony is all wrong. It just—it is built up on a pyramid of hypothetical questions or answers, and it was a buildup, and, really, I must not have known what I was saying when I said some of the things there, because I know they weren't true."

The questions and answers involved constituted, as Lewin sought to show, a virtual admission that quotations reported to the trade as jobber prices were virtually major prices without "saying so."

Steiger insisted that "we asked for sales directly to jobbers."

The court held that his new explanation had "more force to it" than his grand jury testimony.

Steiger was questioned only briefly on cross-examination.

"Did you do anything different as a reporter in 1935 and 1936 than you did in 1934?" Hanning asked.

"No," Steiger answered.

John P. Mosher, Jr., who took the stand following Steiger said he was employed in a supervisory capacity in the Cleveland office of the Oilgram, said he knew information was obtained from major companies, but he didn't know it to be a fact that "the majors sell comparatively little gasoline on the spot market," and he didn't know it to be a fact that prices were based on quotations," rather than actual sales.

Mosher denied he noticed anything unusual about the steady rise of the market early in 1935, as it had done the same thing at various times in the past, but the long level of stable prices that summer and fall was unusual.

Early in the week, Ralph Everitt, of Wichita, Kan., secretary, Globe Oil & Refining Co., was excused subject to recall when he said he had no definite figures immediately available as to whether or not the company's stock inventory was "high" in February, 1936, when the market held firm despite severe weather.

Everitt could not recall, "from memory," whether or not the company's sales diminished in the first three months of 1936, and he doubted his grand jury testimony would "refresh his memory."

At various times during the week, between witnesses, the government introduced letters, tele-

(Continued on Page 82)

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Esperson Building, Houston, Texas

grams and confidential memoranda taken from the files, of corporate defendants, including Shell Petroleum Corp., Pure Oil, Tide Water, Sinclair and Cities Service companies.

One telegram from Pure Oil to Shell said, "Prefer wait for general program. Don't believe individual purchasing will influence price."

Another, sent to Shell on March 18, 1935, signed "McNair," said, "Gasoline purchasing program will be worked out today and not later than tomorrow."

Several messages listed weekly purchases by major companies and one recommended that "450 cars should be bought to bring stocks to normal."

A memorandum from Shell files, dated January 16, 1935, referred to "purchases negotiated for the purpose of stabilizing the market."

A telegram, on January 25, 1936, from J. W. Warner of Tide Water Co. to J. D. Collins reported a steady market, which "marketers now accept as firmly established," though weather was unfavorable and travel in many sections paralyzed and refiners were not trying to push jobbers.

Another from Warner to Collins reported a weakness in the market on February 29, which was "no doubt pleasing to jobbers," as it was the first time in months "published prices have been down so that jobbers have their 5½ cent margin."

On March 14 Warner reported an upturn in tankcar prices, with published prices "more firmly established than a week ago," and on April 4 he reported trading retarded by return of bad weather, but published quotations had succeeded in holding to their level and there was "no fear of a break."

From the Files

From the files of Sinclair Co. came several communications by W. T. Atkins to J. W. Carnes, relating to East Texas purchases, and one from W. A. Tracey to Carnes on May 7, which said, "Cline reports immediate relief needed account few more refineries running," and another, on June 13: "Buckley advises need additional cars 104. Dodge orders cars 10." On February 13, 1936, Tracey reported a surplus of 145 cars, and on April 4, 1935, he wired: "Price still firm 4 cents East Texas. Pure still taking their five cars daily."

Reporting purchases at 5 cents, a telegram from W. T. Atkins to Carnes, said: "Takes all current weekly manufacture . . . If take all, Thursday price will be 5⅛ . . . Twenty-five cars could clean up this week's surplus . . . Refiners refuse to take 4⅝, claiming now in good position . . . Believe this reflected in trade papers."

And a letter, on March 15, from W. A. Tracey of Houston, to D. C. Brown of El Dorado, Tex., reported. "Intense and active work on part of all of us to get prices where they are today. Jobber demand did not do it. Think you know what I mean."

Following Mosher, Harold F. Parsons, of East Lawrence, N. J., testified his company, Tide Water Associated, bought gasoline in East Texas during 1935, and that part of the reason, at least, was a hope it would help to stabilize prices.

Parsons, assistant to the president, E. L. Shea, said purchases were made by authority of the operating committee and approved by Shea. They continued from April to November, then were discontinued until February, and from that time until April, 1936, were made at about five cars a week.

"The purchases made in East Texas," he explained, "were to supplement the production of the company as required for sales purposes. In 1933 and 1934 we made purchases also from the Gulf Coast, and in 1935 and 1936 made purchases in both fields. We continued to buy in East Texas not only for the reason that we needed gasoline, but also because there was an advantage in using the company's tankcars and securing a mileage allowance from the railroads."

"Was the company also influenced by a desire to support the buying movement in which other major companies were participating?" Mr. Chaffetz suggested.

"The company purchased because it required gasoline to supplement its stocks and we believed it was a good thing to take gasoline from East Texas to help stabilize the market."

Parsons' cross examination by B. M. Webster, counsel for Tide Water, was devoted to a long explanation of the official relations resulting from the dissolution and merger of the Tide Water companies of Oklahoma and New Jersey with the parent Associated company.

He was questioned further, however, by Col. Donovan, who brought out that the company's refinery at Bayonne, N. J., had operated at full capacity for 10 years, but had never produced sufficiently to meet requirements. In 1935, Parsons said, the output was 1,150,000 bbls. short, but purchases in that year were less than one-fourth of those made in 1932, and considerably less than in 1933 and 1934. The company has continued to buy in 1937.

As far as he knows, Parsons said, all purchases by the company in East Texas during 1935 were at prices below the low or at the low of the Journal of Commerce and Oilgram. In April and May, when approximately 25 per cent of the year's purchases were made, the market was rising, and the prices paid were one-eighth to one-quarter of a cent below East Texas quotations, but when the market flattened out in the summer all purchases were made at the low of East Texas prices.

During 1935, he also testified, the company would have had no business in Standard of Indiana territory if it had not had jobber outlets, and in that year 91 per cent of its sales in this area were to jobbers, while in 1936 these sales amounted to 90 per cent. The 800 cars bought in East Texas in 1935 amounted to about 25 per cent of the company's total purchases that year, he said.

"Did you buy from the same refiners in 1935 and 1936 as in 1932 and 1933?" Judge Stone inquired.

The company purchased from 11 refiners in 1935 and from one refiner only in 1936. Parsons answered.

"Did you buy as much in East Texas as in 1932 and 1933?" the court asked further.

"I haven't my records with me, so I can't say."

A half day was consumed in reading documents from Shell files after Harry Jacobs, St. Louis, assistant to the vice president in charge of marketing, had been called to identify them.

Weekly Price Reviews

They included memoranda from A. E. Reuther, of the crude oil department, and from "McNair," identified by Jacobs as a "field" scout at Tyler, Tex., for Reuther's department. For the most part they were weekly "price reviews" the majority of which Jacobs said he had prepared at the request of P. E. Lakin, vice president.

Defense objection that they could be only "hearsay" was overruled. They contained references to the "buying group," and were presented as evidence that the majors engaged in "concerted" pool buying with a price fixing motive.

One "memo" from Reuther on January 11, 1935, reported East Texas "clear at the moment," and reflected a general opinion that brokers and jobbers were holding off from the market in anticipation of a breakdown due to the Supreme Court decision invalidating the tender board section of the NRA. It reported a committee appointed at a meeting called by C. E. Arnott, and that a proposal had been made to post prices and report quotations to the journals in connection with the "buying program"; also that each major company be assigned to a seller in the interest of a "closer checkup."

"Haphazard buying will not help," the memorandum said. "It must be orderly and continuous."

Another note to Alexander Fraser, Shell president, Lakin and others, announced the buying movement had started, and advised a premium be paid on middle octane gasoline to "get the journals to move up their prices."

A telegram from R. W. McDowell of Mid-Continent to Mr. Lakin on February 2 announced a meeting of the "tankcar market committee" called at the Chicago office of E. J. Bullock, vice president, Standard Oil of Indiana.

A message to Reuther at Kilgore, Tex., informed him Cities Service was buying all available gasoline from the independent refiners association and "we were able to get only 65 cars."

A telegram from McNair to Reuther, on March 6, 1935, reported, "Texas Co. entering gasoline market in East Texas. Understand H. B. May dealing at Houston today."

Buying of Natural Suggested

Reuther reported in a memorandum to Lakin on March 8 that "Winget of Cushing feels prices should move faster" and quoted prices of 3⅝ cents and 4⅝ cents. He suggested the committee not overlook the effect natural gasoline might have and that it might be necessary to buy some of this product.

A memorandum from Reuther to Fraser and Lakin on February 6 reported the committee on gasoline purchases met at Bullock's office and named those attending. The effect upon prices was discussed, it added, and the committee, "all except Karstedt," agreed a continuous buying program was necessary to "take off the surplus."

It was advised the best way was for individual companies to arrange with individual refiners to keep their surplus off the market and thus "encourage each refiner to stay within his allocation."

Strengthened tankcar prices were reported in subsequent reviews and one declared "activities of state and federal tender boards, coupled with the buying movement," were responsible for the improved condition.

It was "generally assumed that all companies will come into the picture as a stable retail market depends upon a stable tankcar price."

Reuther reported to Lakin on March 15, "Cushing advises good shape. No surplus." And the memo said Phillips had bought 25 cars in 10 days.

Five days later Reuther informed Lakin, "Jacobi tells me Pure Oil not purchasing from its partner, Taxman . . . Jacobi suggests we buy some of this because we do not have to take any of Cushing's."

The weekly letter of March 20 reported an advance of one-fourth to three-eighths of a cent expected shortly with prices improving in Group 3. It also announced "some illegal gasoline on tracks." and reported, "jobbers have been buying for storage in anticipation of higher prices."

Another complication was supplies thrown on the market by tanktrucks since curtailment of tankcar shipments through activities of the tender boards. Majors were being undersold in some spots.

The April 3 letter reported tankcar advances in East Texas, Group 3 and Western Pennsylvania, and that tankcar "buying pools" had been successful in removing surplus from the market, but it announced another disturbing factor—a "deliberate effort to destroy the effectiveness of the major company moves." It remained to be seen whether or not "refiners will hold or attempt to exceed their allowances." Interstate gasoline shipments by trucks were becoming a serious menace . . . Majors having pipe lines were quoting prices below the low as another serious problem. The letter assured a price of 5¼ cents might be anticipated by May 1 "if the program carries through."

The April 10 review reported "for the first time

(Continued on Page 94)

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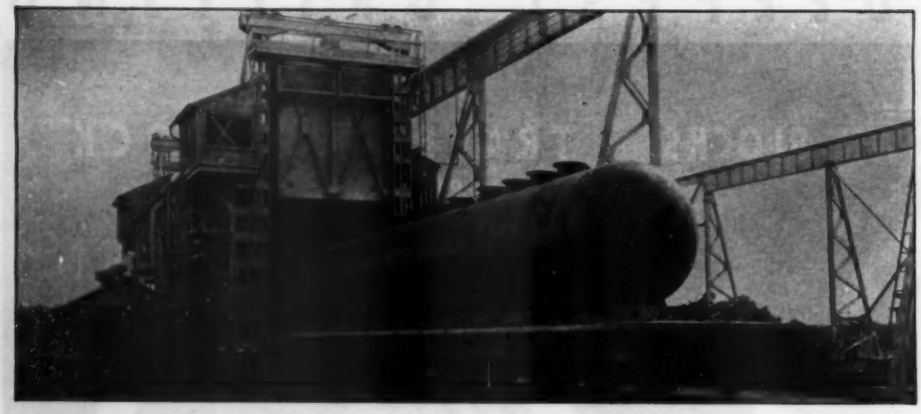
Refinery Expansion



Pressure vessel 67 feet 9 inches long entering the stress-relieving furnace at Birmingham, Ala. From here it will be shipped to the Continental Oil Co. for installation at its Ponca City, Okla., refinery

Continental Revamping and Modernizing Refineries

Continental Oil Co. is revamping and enlarging several of its refineries at various points in the United States to modernize its refining equipment and thus make operations more efficient. The company's Baltimore, Md., refinery has been completely rebuilt and enlarged to a daily capacity of 8,500 bbls. New crude stills were installed and an office building erected. At Denver, Colo., its refinery will be doubled in capacity, to 4,000 bbls., at a cost of approximately $400,000. Also the company is enlarging the capacity and remodeling its Ponca City, Okla., refinery.

Quaker State Erecting New Unit at McKean Plant

BRADFORD, Pa. — The Quaker State Oil Refining Corp. has broken ground for the erection of a new re-run unit, duplicating one already in use, at its McKean plant at Farmers Valley. The company is also erecting an addition to its barrel house and is installing new equipment in the canning department.

Hydro-Pete Erecting Small Refinery at Red Deer

RED DEER, Alberta. — Hydro-Pete Oils, Ltd., of Calgary has purchased a 3-acre site in the West Park area close to Red Deer and is starting the erection of a $32,000 refinery plant. P. L. Hyde is president and principal shareholder.

Control of Heat Discussed at Monthly Meeting of Refiners

SHREVEPORT, La.—The regular monthly meeting of the Ark-La-Tex division of the Western Petroleum Refiners Association was held in Shreveport, on Friday, November 5. The feature of the program was a talking film, "Heat and Its Control," presented by the Johns-Manville Co. R. C. Parlett, of that company's New York office, followed the movie film by his talk on "The Control of Heat Through Proper Insulation." An open forum discussion followed.

Colonial Beacon to Erect Large Terminal in Maine

NEW YORK.—Construction of a large bulk plant at Ligonia, near Portland, Me., to serve as a terminal for all Maine and parts of New Hampshire, has been announced by the Colonial Beacon Oil Co. This new plant will be ready next spring, at which time the company plans to move there from its present quarters in East Deering, Me.

The new plant will provide for the storage of 11,500,000 gallons of petroleum products and will include a 20-car side track, a four-truck loading rack, a three-truck garage, an office, a storeroom for case oil and a warehouse. Facilities will be provided for unloading large ocean-going tankers which will carry products from refineries at Everett, Mass., and Bayonne, N. J

Gulf to Add Stabilizing Unit At the Gerard Point Refinery

NEW YORK.—Contract has been awarded by Gulf Oil Corp. for construction of a debutanizing and stabilizing unit at its Gerard Point, Pa., refinery to Alco Products, Inc. The unit will have capacity for handling 7,500 bbls. of cracked distillate per day. Alco's contract covers a turn-key construction job. The new unit is designed to process cracked distillate from stills and produce a low vapor pressure, debutanized material and a stable butane product.

Gulf operates a complete refinery at Gerard Point (Philadelphia) which has crude oil capacity of 30,000 bbls. per day and its cracking section is capable of handling 19,000 bbls. per day. W. M. Crockett is superintendent of the Gerard Point plant and J. E. Biggins is assistant.

New Japanese Refinery to Be Completed in 1938

The refinery of the Maruzen Oil Co., under construction at Shimotsu, Wakayama Prefecture, Japan, since the early part of this year, is scheduled to be completed by next April, the Nikkan Kogyo learns. The refinery covers a total area of approximately 20 acres, and is designed for a daily refining capacity of 14,200 bbls. The plant is close to two sets of 60,000-bbl. tanks of the Tsuchii Oil Co., an affiliate of the Maruzen interests.

Expansion Program Started by Socony-Vacuum at Cleveland

CLEVELAND, Ohio.—A $200,000 expansion program has been started by Socony-Vacuum Oil Co., Inc., at its plant here. Work included in the program consists of rebuilding storage facilities, adding to blending facilities, modernizing the plant and installing machinery for canning smaller package goods. Also, a two-story building to house a new research laboratory is to be erected.

Taxman Refining Co.'s Plant At Wichita Falls Is Sold

FORT WORTH, Tex.—Sale of Taxman Refining Co.'s Wichita Falls plant to the Texas Railway Equipment Co., of Houston, has been announced. The plant, at present shut down, was built in 1929 and has a daily crude capacity of 3,250 bbls. It is also equipped with a 1,100-bbl. Donnelly cracking unit. The new owners have taken charge with Phillip Peden of Houston in charge.

New Refinery to Be Erected In Miller County, Ark.

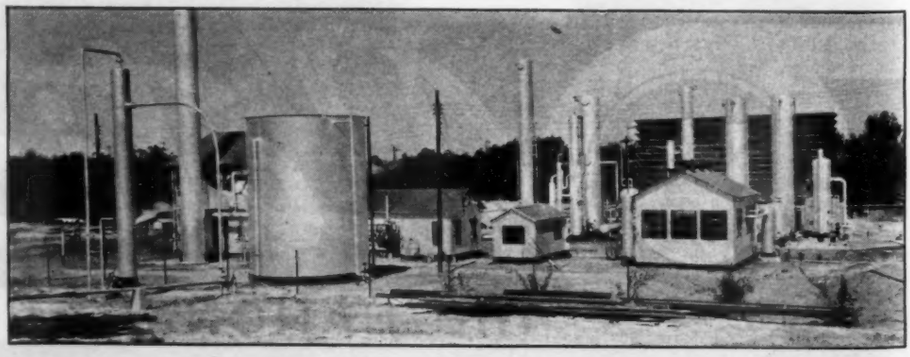
SHREVEPORT, La.—Construction of a new refinery in the Miller County, Arkansas, extension area of the Rodessa field is to be started soon by South Arkansas Refining Corp. The company, a newly organized firm, is headed by T. Trevillion. The plant will be located south of Ravana in section 32-19-28, and will have a daily capacity of about 3,500 bbls. Clearing of the plant site has already been started.

Natural Gasoline

Casinghead Gas May Supply Central Michigan Towns

SAGINAW, Mich.—Though a Public Utilities Commission is expected to provide a temporary solution of the problem confronting Gas Corp. of Michigan, facing shortage of gas to supply its Mount Pleasant, Rosebush and Clare clientele, permanent solution probably rests with the success of projected experiments by Pure Oil Co. in the collection and purification of casinghead gas from its Sherman field oil wells.

Assurances were given the commission by Henry



Glen Rose Gasoline Co.'s 40,000,000 cubic foot capacity high-pressure absorption gasoline plant on the Louisiana side of the Rodessa field

Gellert, vice president of Gas Corp. of Michigan, if permits are granted for the emergency solution—"borrowing" of 100,000,000 feet of gas this winter from Consumers Power Co.—a deal would be made with Pure Oil Co. for rectification of the estimated 2,000,000,000 feet of casinghead gas produced by its Sherman field wells.

Mr. Gellert testified this source would provide a long-term gas supply for the three towns in the center of the state's oil and gas areas and would yield natural gasoline worth $150,000.

Contract Let for Barnsdall Plant Near Odessa, Texas

Barnsdall Oil Co. has let contract for the construction of a gasoline plant in the Foster pool near Odessa, Tex., to Petroleum Engineering, Inc., of Tulsa. The plant will be of the combination compression-absorption type, and will handle approximately 12,000,000 cubic feet of gas. Ground was broken at the plant site last week and it is planned to begin operation the early part of January. Approximately $350,000 will be spent on this installation.

New Rodessa Field Plant Is Progressing Rapidly

SHREVEPORT, La.—The Marion County, Texas, absorption gasoline plant of the Arkansas-Louisiana Gas Co., about 2½ miles north of Jefferson in the Rodessa extension area, is progressing rapidly. Concrete foundations have been poured, and nearly all of the machinery is on location. The plant will have a capacity of about 25,000,000 cubic feet daily, and a gasoline output of about 15,000 gallons daily.

Natural Gas

Japanese Try Cracked Gas For City Gas Carburation

The Yokohama Gas Works, Japan's oldest unit in the city gas field, has recently decided to increase the calorific value of its supply gas by mixing it with cracked gas of high heating value. The company has taken this step to keep up with the steeply rising demand for domestic and industrial gas in the port city, according to the Journal of the Fuel Society of Japan.

The cracked gas is supplied by the Ogura Petroleum Co., Limited, a local refining firm operating two cracking plants with a combined daily capacity of 10,000 cubic meters. The gas has an average heating value of 13,000 to 14,000 calories per cubic meter and consists of the following components, according to low temperature fractionation analysis:

	Per cent
Hydrogen	5.7
Methane	38.1
Ethylene	12.0
Ethane	15.0
Propylene	10.2
Propane	8.0
C-4 Hydrocarbons	4.8
C-5 and higher hydrocarbons	6.2

The calorific value of town gas in Yokohama, now rated at 3,200 calories per cubic meter, is to be elevated to 3,800-4,000 calories by means of carburation with the cracked gas.

There is of course the problem of mixing the two gases with the greatest factor of safety and economy. In a paper contributed to the above-mentioned journal, R. Kada, an engineer of the Yokohama Gas Works, discusses three methods by which this may be done.

Supply gas of the Yokohama Gas Works being a mixed gas produced by the retort-generator system, it does not easily lend itself to diluting the cracked gas, according to Mr. Kada, and the carburetted gas thus produced has a tendency to cause back-fire trouble.

Discussing, as an alternative, the thermal decomposition of the cracked gas in an iron retort containing coke grains in the presence of air, Mr. Kada states that the cracked gas thus treated lost 20 per cent of its original heating value, although the product increased in volume by 20 per cent. In view of the technical and economical disadvantages of these two methods, the Gas Works resorted to dilution of the cracked gas with producer gas in a small supplementary gas producer. The diluted gas is then added to the mixed gas from the retort-generator. Very satisfactory results are said to be obtained by this method.

The most satisfatory mixing ratio of the three gases is: Cracked gas, 7; mixed gas (retort-generator gas), 36; producer gas, 17, or 11.7 per cent, 60 per cent, and 28.3 per cent, respectively.

While the heating value of the retort-gas and producer gas is only 3,300 and 1,500 cal./cbm. respectively, the resulting carburetted gas has a heating value of 3,800 cal./cbm. as scheduled.

Natural Gas Supply Offered To Ontario Towns

KITCHENER, Ontario.—The Kitchener Public Utilities Commission has received a proposition from Otter River Gas Corp., headed by A. B. Holmes of Toronto, for a supply of natural gas, distribution to be handled by the municipally owned systems which now serves Kitchener, Waterloo and Bridgeport with artificial gas from a publicly owned plant, at a rate of 95 cents per 1,000 feet. The Otter River company proposes to deliver natural gas at the city limits at a rate of 42 cents per 1,000 feet. The project would involve a short extension of the Dominion Natural Gas Co. transmission line from Preston to Kitchener.

The public utilities commission has asked the Ontario Research Foundation at Toronto to make a survey of the gas situation at Kitchener before reaching a decision.

Texas Dry Gas Production Increased in September

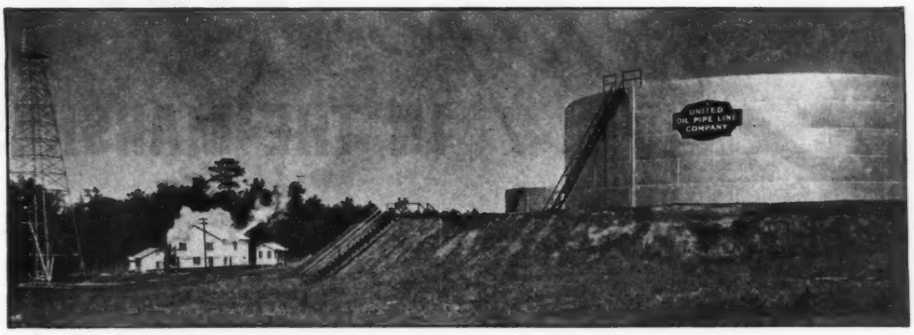
From the 317 gas reservoirs in Texas reporting, there were 2,928 wells producing 1,798,736,000 feet of gas daily during the month of September, 1937, according to the monthly report of the Texas Railroad Commission. From these wells, 1,109,589,000 feet of sweet gas and 689,147,000 feet of sour gas were produced. This dry gas was disposed of as follows: 26.65 per cent to pipe lines for domestic and industrial light and fuel purposes; 4.48 per cent for lease development and operation, including gas-lift, repressuring and drilling, and 65.87 per cent to gasoline plants for gasoline extraction. Gasoline plant residues were also delivered to pipe lines, used for lease development and carbon black manufacture.

The 132 plants operating and reporting processed a total of 2,198,546,000 feet of gas daily from 33,728 oil wells and 1,016 gas wells. Dividing this total into type gases there were 958,295,000 feet of casinghead, 564,858,000 feet of dry sweet, and 675,393,000 feet of dry sour gas. Of the total gas processed by the gasoline plants, 6.18 per cent was lost during the extraction of gasoline, 15.39 per cent was used for plant and lease purposes, 41.43 per cent was sold to carbon black plants, and 24.26 per cent was disposed of to pipe lines; 12.74 per cent was blown to the air, being in equivalent casinghead gas.

The gasoline plants recovered 2,182,238 gallons of 26-70 grade (equivalent) gasoline and seven plants produced approximately 236,201 gallons of butane-propane daily. The average gallons per 1,000 feet of gas processed was 1.006. This gasoline production is in equivalent approximately 150,000 bbls. of crude oil daily. The 40 carbon black plants reported 910,905,000 feet of residue gas burned daily. From this gas 1,242,066 pounds of carbon black were produced daily, or an average of 1.36 pounds of carbon black per 1,000 feet of residue gas processed.

J. Elmer Thomas, geologist of Fort Worth, Tex., addressed the Houston (Tex.) Geological Society last week. Mr. Thomas was a delegate to the International Geological Congress in Moscow and after the convention he made a 43-day trip through that country.

Pipe Line Activity



UNITED OIL PIPE LINE CO. STATION AT RODESSA

SHREVEPORT, La.—United Oil Pipe Line Co. is the new oil transporting company formed after recent adjustments in the corporate structure of the United Gas System. Its 8-inch line runs from the Sexton station in the heart of the Louisiana portion of the Rodessa field to Kilgore, Tex., where deliveries are made to Shell and Atlantic Pipe Line companies for movement to the Gulf Coast. Daily volumes average about 25,000 bbls. The Sexton station and tank farm in the Rodessa field were originally built by East Texas Refining Co. and later sold to the United Oil Pipe Line Co. interests.

Lisbon Field Now Served By Second Pipe Line

SHREVEPORT, La.—Caddo Pipe Line Corp., a subsidiary of Grogan Oil Co., Shreveport, has completed its new 6-inch welded line into the Lisbon field, and will immediately provide that field with its second, but much needed, crude outlet. Although daily allowable in that field is 10,000 bbls., production there last week was only 3,270 bbls. per day, as wells had to be cut back because of Gulf Pipe Line withdrawals.

Feeder Line Being Laid In North Crowley Field

HOUSTON, Tex.—Standard Oil Co. of Louisiana is laying approximately 3½ miles of 4-inch feeder line from its main line at Crowley to the North Crowley field in Acadia Parish. The feeder line will tie into the 8-inch line which is a part of the company's 150-mile pipe line system, recently completed from Baton Rouge which serves the Jennings, Roanoke, New Iberia and Jeanerette fields in Coastal Louisiana.

Barge drilling

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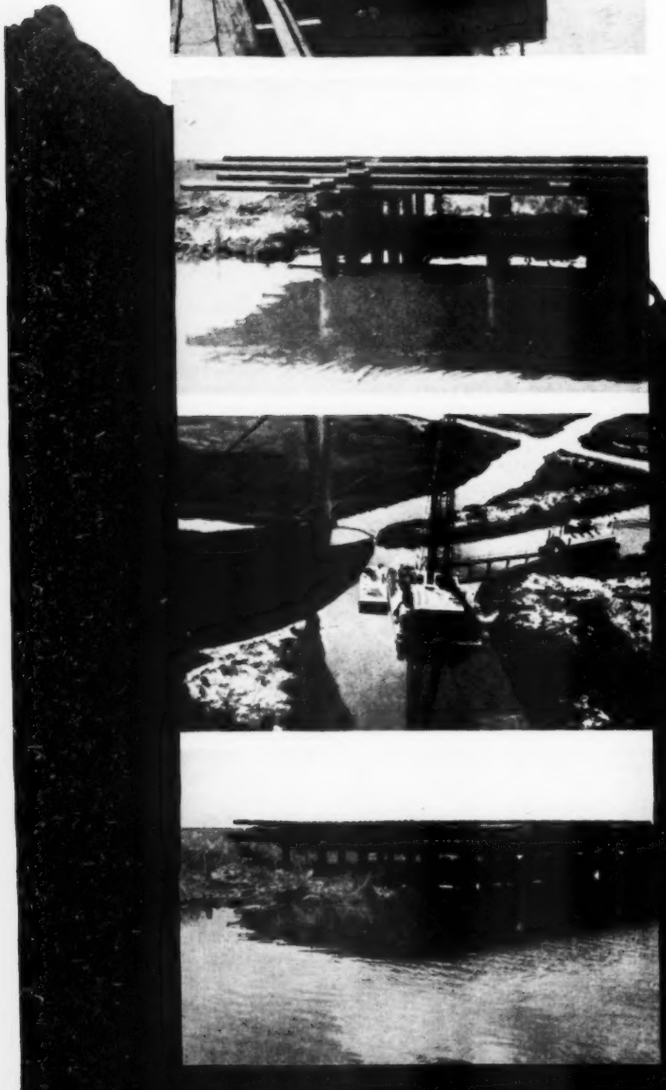

Down in the swampy b[illegible] of southern Louisiana, you [illegible] twelve (12) recently [illegible] wells, all approxim[illegible] feet in depth, cased [illegible] to bottom [illegible] "Star[illegible]"

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Pacific Section of the A.A.P.G. Holds Interesting Session

By T. P. SANDERS

LOS ANGELES, Calif., Nov. 8.—The Pacific section of the American Association of Petroleum Geologists held its fourteenth annual meeting here November 4 and 5. About 300 were present at the two-day sessions during which 13 technical papers were presented. The number of members taking part in discussions was unusually large. The first speaker, introduced by Harry R. Johnson, president, was Gerard Henny. Defining geosynclines, comprehensive series, and peneplains, Mr. Henny's address was well received, even by seismologists, to whom the speaker referred as "geo-sorcerers." It was brought out that while a comprehensive series was intended to mean a uniform series, and a peneplain meant a land segment eroded to base level, the terms could be applied to features approaching the ideal. A belief was stated that the original San Joaquin Basin extended in a northwest direction with the north rim lying just above Tulare Lake. In this case future discoveries of oil along this rim, which is now buried below valley sediments, would be expected.

Dr. F. M. Anderson discussed the Upper Cretaceous deposits of California and Oregon. These strata have recently come to attention of the petroleum geologist because of gas production from them near San Francisco. They make up the Chico series, which has an aggregate thickness of 25,000 feet or more. At the base of this series is a great unconformity and overlap of late Albian time. The Upper Cretaceous can be divided into the Gaines group, which includes late Albian to Turonian; and the Panoche group, which takes in Coniacian to Campanian. The Chico series dominates the San Joaquin Valley section, and extends half way around the world, belonging to the Indo-Pacific Province.

Coast Ranges

Dr. Bruce L. Clark presented evidence supporting his belief that faulting is the fundamental structure of the Coast Ranges, while folding is secondary. His paper, "Faulting or Folding in the Coast Ranges, Which?" dealt mostly with the Coalinga area and the Ventura Basin. He characterized many of the folds as "drag folds" which followed block faulting. Because of disagreement with the popular belief, much discussion resulted which brought out that thorough study of individual faults in California was needed. J. R. Pemberton, oil umpire, predicted the cause of diastrophic movements would have to be understood before the structural results of such movements could be successfully worked out. As an example, he brought out the hypothesis that the capture of the moon by the earth resulted in intense diastrophism due to the eccentric orbit of the moon immediately after its capture. Some astronomers believe this capture took place in Cretaceous time, in which case it may have influenced formation of Coast Range structures. However, Dr. Anderson considered it more likely the moon had been captured during late Jurassic time, since this period was characterized by intense diastrophism.

"Geology and Oil Prospects of Victoria, Australia," was the title of Dr. A. J. Tieje's paper. In Victoria only Tertiary rocks offer hope to the oil man. In the Lake's Entrance area oil occurs in the water supply, yet the production of the oil wells is only 15 gallons of heavy oil, containing no gasoline or kerosene, per day. This occurs in a glauconite sandstone at 1,400 feet, and is underlain by artesian water. Between this production and the barren Baragwanath anticline 50 miles west the region is untested, with some hopes remaining.

"California Earthquakes" were discussed by G. B. Moody. Stating there had been thousands of destructive earthquakes in California, only three were considered major quakes, those of 1857, 1872, and 1906. An earthquake cannot be predicted from frequency of previous quakes or from fore-shocks, but the speaker believes since earthquakes are natural phenomena brought about by natural causes, it is possible prediction will some time be possible. Since oil is found along faults, the petroleum geologist is concerned with earthquakes.

Seismic Exploration

G. M. Cunningham brought out in his address on "Seismic Exploration in Difficult Areas" that in glaciated regions, such as eastern Montana and the Dakotas, only the shots taken in creek bottoms below the drift were of much value.

The McDonald Island gas field was described by George L. Knox. It is 10 miles north of Stockton, Calif., and about 50 miles east and north of San Francisco. McDonald Island is one of a group of islands in a delta area of the San Joaquin and Sacramento Rivers. The field was discovered by Standard Oil Co. as the result of a reflection seismograph survey. The first well came in May 27, 1936, for 26,000,000 feet per day from a depth of 5,227 feet, near the base of the Eocene. Later drilling has checked the shape of the structure as postulated from the seismograph survey. Discussion by Mr. Cunningham disclosed the seismograph results had been interpreted by Mr. Knox after they had been rejected as worthless by the geophysicists. This was offered in support of the theory that geologists should cooperate with seismograph parties in interpretation of results.

The Friday morning session opened with "Review of the Santa Maria Valley Oil Field," by Dean Sheldon. This field has produced 900,000 bbls. of 16-gravity oil from 37 wells. At present there are 36 drilling projects in an area of 6¾ square miles. Production is from brown shale and sand of the Monterey formation of Middle Miocene age. It overlies a basement complex of questionable Franciscan age. The Sisquoc formation of questionable Lower Pliocene, and the Foxen formation of Upper Pliocene are nonproductive although they have some saturation. The structural trap is a Sisquoc overlap of an eroded surface with indication faulting has controlled oil accumulation to some extent.

"Notes on the Extent of the Vedder Sand in San Joaquin Valley" were presented by Glenn Ferguson which brought on widespread discussion. Chief concern was whether the deep productive sand discovered by Union Oil Co. in No. 1-34 Kernco was the Vedder sand of the Round Mountain field occurring near the base of the Miocene. The speaker said, "The sand found in the Union well is at least in approximately the same stratigraphic position as the Vedder sand."

"El Segundo Field, Los Angeles Basin, California," was presented by R. C. Reese. Development of this field has been sporadic due to its irregular structure and the uncertainty of obtaining commercial producers. Recent developments have been greatly accelerated by completion of 4,000-bbl. wells on the west side of the proved area. The structure is essentially a schist high overlapped by Upper Miocene sediments. Oil occurs in a basal Conglomerate and in the underlying schist where it is sufficiently fractured or weathered to act as a reservoir.

Read Winterburn of Union Pacific Oil Co. discussed the Wilmington field. With over 270 wells drilled, the structure has been defined in the section lying within the Los Angeles city limits. This is an anticlinal nose dipping northwest. Two main faults have had a profound influence on the accumulation. Study indicates folding and faulting occurred simultaneously with the deposition of the Repetto beds. No movement has taken place since deposition of the Upper Pico beds, which rest unconformably on the Repetto.

Sediments Off Coast

Due to the unusual interest in tideland drilling and proposed legislation to allow this development, Francis P. Shepard's paper on "Sediments Off the California Coast" attracted considerable discussion. It was stated that while much material was being carried to the California coast by rivers, most of this by-passes the continental shelf, and is deposited in deep basins, or on the ocean floor.

"Geological Significance of the Glauconite Group," given by E. Wayne Galliher, briefly discussed the occurrence of glauconite in the older sediments and its relation to biotite, vermiculite, and nontronite.

New officers elected by the Pacific Section of the American Association of Petroleum Geologists were: W. S. W. Kew, Standard Oil Co., president, and E. Wayne Galliher, chief geologist, Barnsdall Oil Co., secretary-treasurer.

A meeting of the Pacific Section of the Society of Paleontologists and Economic Mineralogists was held Thursday evening, November 4. New officers elected were: R. B. Hutcheson, chief paleontologist of Superior Oil Co., president, and Louis J. Simon, associated with Prof. Paul Goutkoff, consulting paleontologist, secretary-treasurer.

Francis P. Shepard, who also presented an A.A.P.G. paper, entertained the group with a discussion of "Biological and Possible Economic Significance of Large Pleistocene Changes in Sea Level." Some evidence suggests a lowering of the sea levels during Pleistocene time, possibly due to formation of the ice caps. This had the effect of increasing salinity, eliminating shelf areas, and exposing marginal deposits to subaerial erosion. Possible relations to petroleum exploration were considered.

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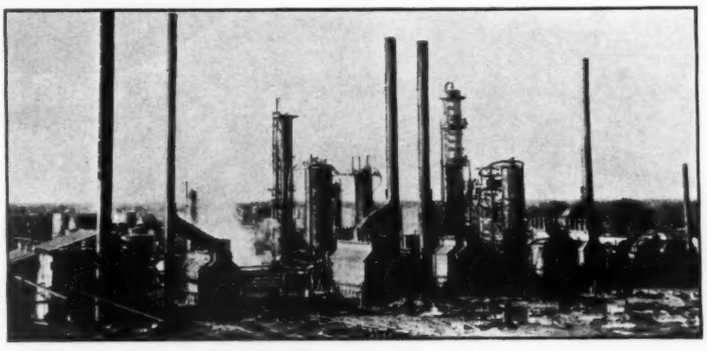
New Talco Specialty Refinery Is Placed in Full Operation

By MITCHELL TUCKER

When the new Talco Asphalt & Refining Co. plant at Mount Pleasant, Tex., went on full production recently the final link to the integrated operations of the Byrd-Frost-Lucey-Fair interests in the Talco field was completed. This group of affiliates, through its producing companies, is now the second largest producer and holds the second largest portion of crude oil reserves at Talco. Production from the properties is moved from its gathering system in the field to the refinery site in Mount Pleasant, 18 miles south of the field, through the jointly-owned Talco Pipe Line Co.'s 5½-inch pipe line, and is being refined and sold by its recently completed Talco Asphalt & Refining Co. plant.

Limited refining operations were begun on June 24 by firing one crude still for the manufacture of asphalt products, straightrun gasoline, and gas oils. The new Dubbs cracking unit was put into operation on October 18, permitting the running of about 7,500 bbls. of Talco crude per day to stills for the plant's capacity operation. This specialty refinery is now manufacturing a cracked 68-70 octane gasoline, all grades of specification asphalt, flux, road oils, cracked fuels and distillates. Talco crude is among the best domestic oils suitable for the manufacture of asphalt products.



Construction scene at the new Talco refinery

The cracking unit is of the selective type, designed with two cracking furnaces and a combined secondary system in which the light and heavy cracking stocks are segregated for charging into separate heaters. Developments in this direction have permitted greater yields of high octane and better quality gasoline to be obtained by selective cracking, because temperatures and pressures can be separately applied to each type of stock. Important operating efficiencies and economies are also accomplished through this type of selective cracking unit.

The pipe line from the field delivers into two 55,000-bbl. receiving tanks in the plant yard, from which crude is taken into the two 10,000-bbl. raw charging tanks to the stills.

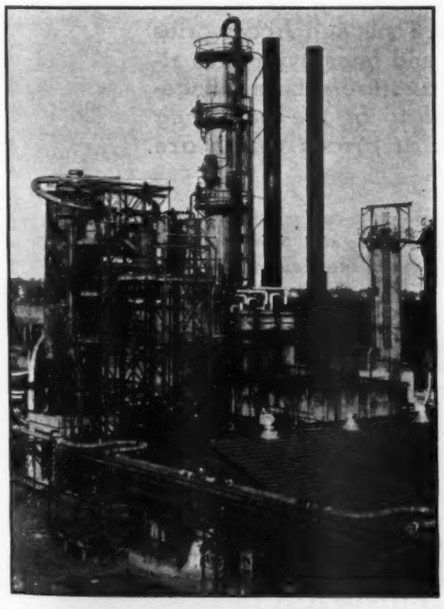
The raw crude is picked up by cold-charge pumps and moved through the heat exchanger on the cracked gasoline, where temperature is raised to about 220° F. After passing from this point through the salt settling drum, the crude goes into the exchanger on the low-pressure cooling oil, where it is lifted to about 325° F. Thence, it is directly delivered to the crude and asphalt heater. Being of the Universal center wall up-draft design, crude travels through the convection section, up the hip tubes, and down one side of the radiant section, going from the crude coil at about 650° F. into the crude fractionating column. The other radiant section in this still is used for lifting temperature of the asphalt bottoms from the fractionating column to the required figure before delivery into the vacuum asphalt tower.

The crude fractionating tower has a 25-foot base, is 96 feet high, and is constructed with 29 decks. Bottoms from this column are an asphalt flux, passing back to the inlet heating coil at about 600° F. and released at around 700° F. to the vacuum column. Superheated steam (approximately 800° F.) is used in the asphalt vacuum column, and specification products are taken off the bottom. By regulating temperatures in the asphalt coil of the original still, and the amount of reflux on cooling, the penetration or hardness of the asphalt products can be controlled. Specification cut backs, road oils, etc., are made in the blending tanks by agitating and circulating with blending pumps.

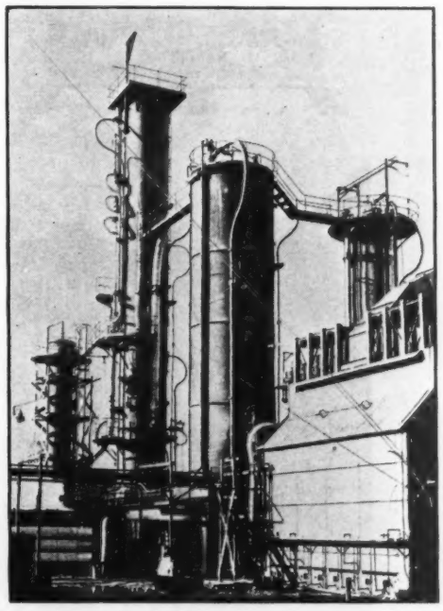
In the manufacture of asphalt products requiring greater consistency under certain temperatures, air is used to "blow" or oxidize the bottoms as they come from the vacuum tower. This is essentially a batch operation for special orders, or to desired specifications.

A very low-gravity gas oil is taken off the top of the vacuum tower, and is mixed with other cuts from the crude fractionating tower, as cracked charging stock. One gas oil is taken off the fractionating tower, of about 30 degrees gravity. Both cuts can be mixed, or run separately as charging stock to the cracking unit. The straightrun gasoline and kerosene from the fractionating tower is later reformed as additional charge to the cracked fractionating tower.

The mixed charge of gas oils is fed to the absorber column, where free gas is taken off the top to be used as fuel in refinery operations, and bottoms are pumped into the cracked fractionating column below the center deck. Hot vapors from the flash chamber enter below, and cause a separation of the light and heavy cracked charging stocks, permitting the light oil to be drawn off above the center deck



Talco Asphalt & Refining Co. auxiliary pump room is shown in the foreground, and the asphalt vacuum column in the background



Flash chamber, reaction chamber, and cracked fractionating column in Talco's new plant at Mount Pleasant, Tex.

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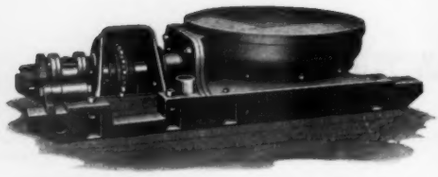

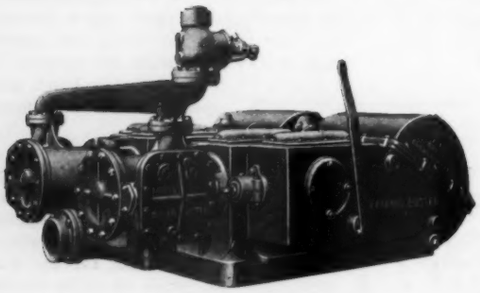

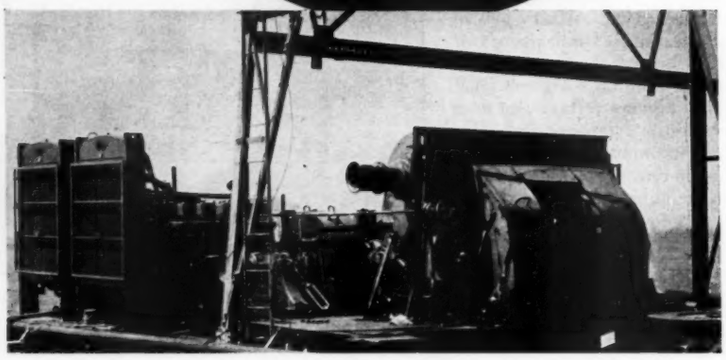

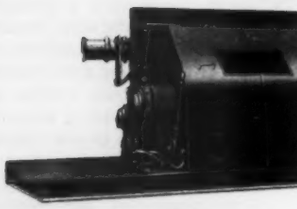

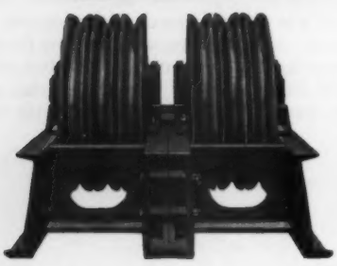

BRIDGEPORT MECHANICAL ROTARY DRILLING RIGS powered with WAUKESHA gas-gasoline-butane Engines; or with CATERPILLAR DIESEL Engines; GUMBO BUSTER Rotary Machinery; NATIONAL TUBE Drill Pipe; and Tools and Accessories of the most modern and latest types, are always *immediately available* from Bridgeport stocks, *at terms to fit the operating requirements, and at prices which are always competitive.*

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MACHINE COMPANY
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and the heavy charging oil near the bottom, for delivery to their respective cracking furnaces.

Both the light- and heavy-oil furnaces are of the center wall updraft design. Movement through the heavy-oil furnace is a split flow throughout, having an inlet temperature of about 720° F. and a discharge temperature of 920° F., pressure 620 pounds. The light-oil furnace has a split feed in the convection section and a series flow through the radiant section. Inlet temperature to this furnace is about 575° F. and outlet temperature about 970° F., with a pressure of 700 pounds.

Discharge from both stills is into the solid forged reaction chamber, having a wall thickness of about 5½ inches and a weight of 120 tons. High-pressure quenching is performed here at about 250 pounds pressure, and the stock then passes through a remote controlled manually-operated pressure reduction valve. The release of pressure accomplished here, down to about 75 pounds and an average temperature of 710° F., causes vaporization as the charge is delivered to the flash chamber.

Reforming Heater

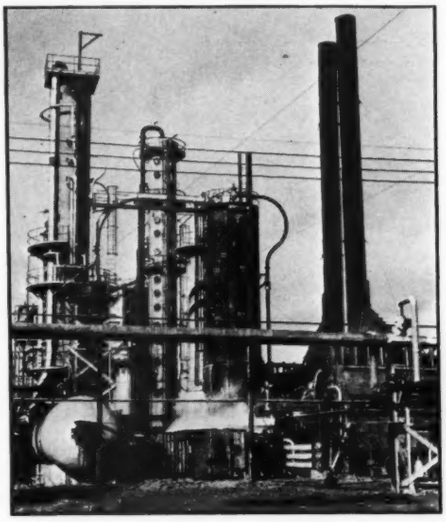
From this point the vapors pass into the cracked fractionating column as heating vapors. The bottoms, consisting of a 0 to 2 gravity cracked residuum, comes off at its own pressure through a heat exchanger having as its cooling medium the cold charge to the reforming heater. The cracked residuum is used as road oil, boiler fuel, or for similar purposes.

The reforming heater is of straight series-flow design. Straightrun gasoline and kerosene coming off the top of the crude fractionating column is charged through a heat exchanger and into the reforming heater for discharge into the flash chamber at about 1,010° F. Here, as in the reaction chamber, pressure is brought down to 75 pounds by a remote controlled manually-operated back-pressure valve before introduction into the flash chamber.

Topping from the cracked fractionating column goes into the accumulator tanks and from there is picked up by the stabilizer charge pump and run through the stabilizer heat exchanger (heated by low-pressure cooling oil from the crude fractionating column). Off the bottom of the stabilizer the stabilized gasoline is run to the caustic scrubber and run-down tank. The doctor treater takes suction on the run-down tank and treats into the sweetened gasoline settling tank, thence going into the gasoline storage tanks and inhibited to complete the finished 68-70 octane cracked gasoline. By varying the operation of the cracked fractionating column slightly, cracked naphtha or distillates can be taken off below the gasoline if desired.

There are two 375-hp. boilers, built of weather-proof construction. At a 200 per cent capacity rating, one boiler can supply all normal plant requirements. Connections are made to the natural gas distribution system operating in Mount Pleasant for gas if ever needed.

All auxiliary pumps in the refinery are electrically driven from power manufactured in the plant's generating station. Here Worthington vertical gas engines are direct connected to G.E. generating equipment, consisting of three units, two large ones providing 200 kw. each, and one furnishing 100 kw. About 300 kw. will meet normal requirements, so one of the large units is usually held as a standby.



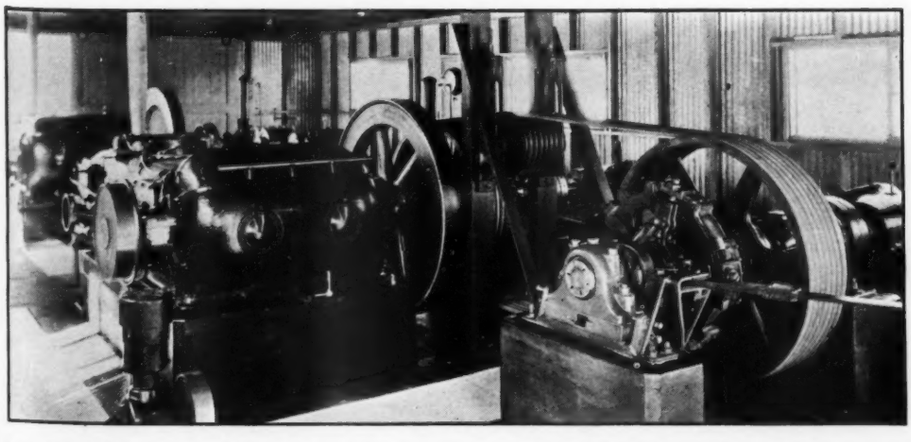
Fractionation equipment and asphalt tower in the new Mount Pleasant refinery

Air compressor equipment, electrically driven, is housed in this building. The compressors are so manifolded that either 40-pound or 125-pound air can be supplied. The lower pressure is used for plant control purposes, and the 125-pound air for tube cleaning and other operational purposes.

Water for plant operations is obtained from a 400-foot well, and a lake has been constructed nearby to provide water in case of emergencies. A 198-by 35- by 18-foot Fluor cooling tower, fed by electrical pumps (direct connected to steam turbines in case of electrical pumps shutdown) constitutes the water system. Normal circulation rate is about 4,200 gallons per minute, but a capacity rate of about 5,500 gallons per minute is possible.

The refinery laboratory is complete in every respect, including facilities for making all distillation tests, ductility baths on asphalt products, vapor-pressure baths, with special rooms for steam tests, ovens, balances, etc.

The instrument board is located in the control house, where all the auxiliary plant pumps are installed. The latest type flow controllers, liquid-level regulators, pressure controllers, and pressure-recording and temperature-indicating and recording instruments are included in the control board. The remote controlled back-pressure valves on the flash and reaction chambers are situated nearby, allowing a close correlation of the various plant operations at this centralized point.



Interior of Talco Pipe Line Co.'s main line pump station in the Talco field, which is moving crude through its 18-mile line to the affiliated Talco Asphalt & Refining Co.'s 7,500-bbl. plant

OBITUARIES

L. L. DIMIT, 86, veteran of the oil industry in four states, died at his home in Neosho, Mo., November 3. He was born in 1851 in Allegheny County, Pennsylvania. His first work in the oil fields was as a "water boy" at 11. In 1867 at the age of 16, he secured his first straight-time job in Butler County, Pennsylvania, as pumper for Jonathan Watson & Co. (Brewer, Watson & Co., 1853; Pennsylvania Rock Co., 1855). In 1870 he went to Parker's Landing with Shealds Adams & Co., later becoming connected with Bettman, Watson & Bernheimer. In 1898, he was transferred to Grant County, Indiana, and thence to Belmont, W. Va. The firm became the Hudson Oil Co. and in 1900, he went to the Indiana fields, as superintendent of all departments until 1916, when he was transferred to Bowling Green, Wood County, Ohio. He removed to Oklahoma in 1918 at Morris. In 1919, he entered the service of Gypsy Oil Co., until retirement at 76, in 1927. He is survived by three sons, all active in the oil industry: W. H. Dimit, Fly, Ohio; J. L. Dimit, Gulf Oil Corp., Sapulpa, Okla., and C. P. Dimit, vice president, Phillips Petroleum Co., Bartlesville, Okla.

ASA BRUCE BEMENT, 64, died suddenly of a heart attack at Bedford, Ind., October 26. He was one of the pioneer operators in southern Indiana and also operated in Louisiana, Arkansas and the Mid-Continent.

A. T. (TOM) WOLFE died suddenly in Wichita Falls, Tex., on October 21 from an acute heart attack. He was born in Armstrong County, Pennsylvania, November 17, 1857, and entered the oil industry at 17, becoming active in the Ohio, Illinois, Indiana, Kansas, Oklahoma and North Texas fields. He was trustee and manager of the Texokan Producing Co. until 1927 when he began operating with his son, Frank J. Wolfe.

Proration Office Changes

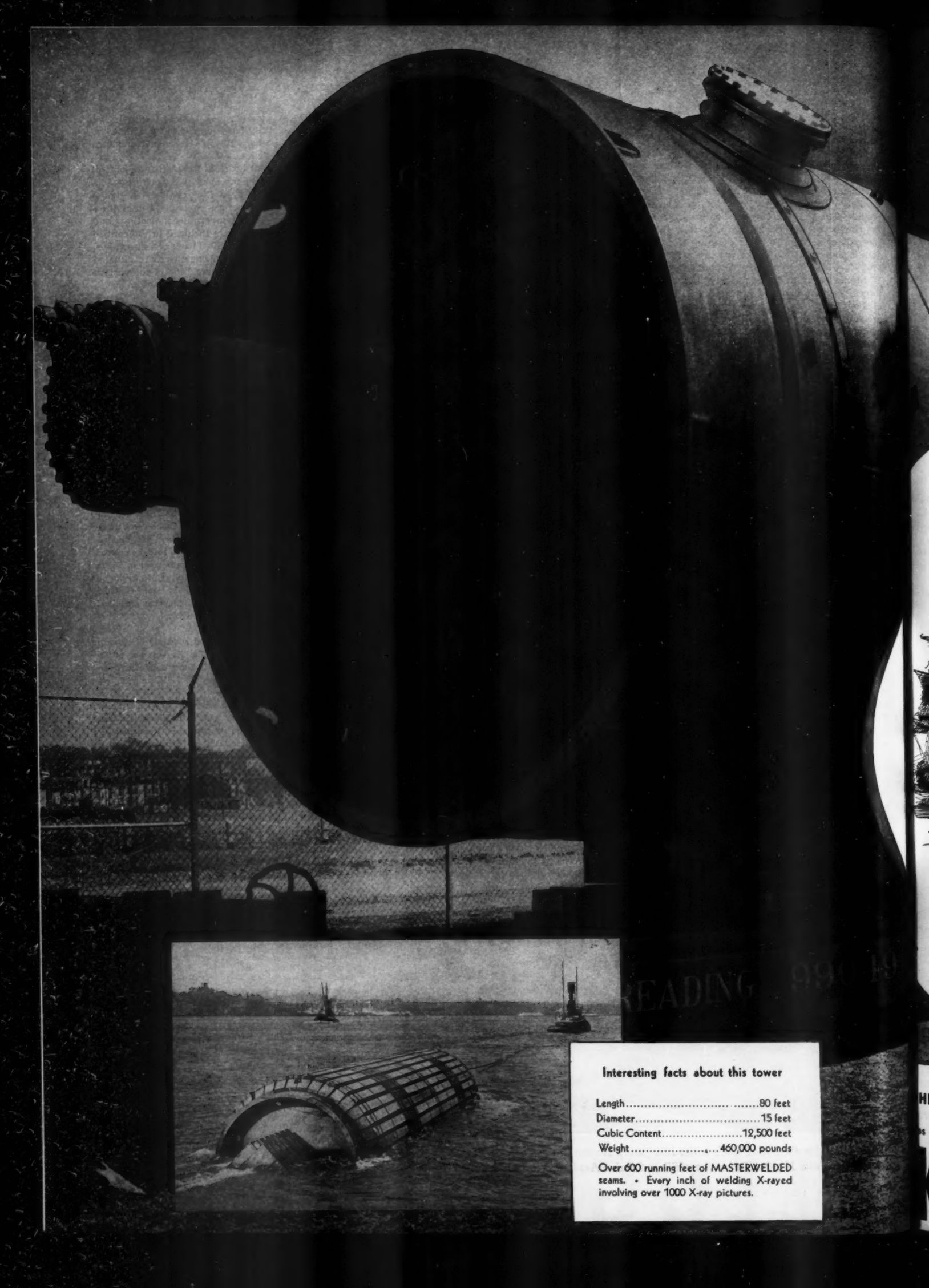
Kansas Pool Names

Names of several of the newer Kansas oil pools have been changed and others joined with larger pools nearby, it is announced in the November proration report of E. G. Dahlgren, director of the conservation division of the Kansas Corporation Commission.

The Peter and Schrepel pools of southeastern Barton County are joined to become the South Silica pool, and the Kowalsky pool in the same general area is named West Silica. The Ainsworth and Steuder pools of northern Barton County are joined to become the South Susank pool, and the McClanahan area of the same county is renamed South Trapp pool.

The Brothers area of Rice County becomes the East Hauschild pool; Hubenett area of Rice County is renamed North Welch pool; Hartnett pool of Stafford County becomes the Zenith pool, and the Richardson sector of the same county is renamed the Hudson pool; the Medicine Lodge pool of Barber County becomes South Medicine Lodge, while the erstwhile Whelan pool of that county now is the North Medicine Lodge pool.

H. C. Dye, vice president and drilling superintendent of the Taft Well Drilling Co., Bakersfield, Calif., has gone to Dallas, Tex., for an indefinite stay. The entire trip was to be made in a plane belonging to his company.



Interesting facts about this tower

Length	80 feet
Diameter	15 feet
Cubic Content	12,500 feet
Weight	460,000 pounds

Over 600 running feet of MASTERWELDED seams. • Every inch of welding X-rayed involving over 1000 X-ray pictures.

TWICE THE GROSS TONNAGE OF *the Mayflower*

● When the Pilgrim Fathers sailed across the Atlantic in the Mayflower to found a new nation they made history.

When The M. W. Kellogg Company lowered into New York Bay this pressure vessel weighing 460,000 lb.—twice the gross tonnage of the historic Mayflower—it made industrial history.

Too big and too heavy to be handled by regular transportation methods, the tower is being towed a distance of 1,371 miles through rivers, canals and four of the Great Lakes to its destination at Whiting, Indiana.

This tower is part of a single order for refining equipment weighing a total of 34,361,000 pounds.

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"Masterweld" pressure vessels for the Power, Refinery and Chemical Industries· Power Plant and Industrial piping. Heat Exchangers, Radial Brick Chimneys, Plastic Refractories. Cross, Holmes-Manley, de Florez and Tube and Tank cracking units. Gas Polymerization Units. Deasphalting, Dewaxing, Solvent Extraction, Acid Treating Plants, Absorption Plants and Pipe Stills

PRESIDENT BYLES

(Continued from Page 70)

those who have had to obtain permits for the erection of service stations would like to be compelled to obtain licenses to do business at all? As to who would grant or refuse or revoke such licenses, and for what reasons? What governmental authority would be vested with the power to determine minimum price-posting, and how such minimum prices would be arrived at under different and ever-varying conditions? How could adherence to compulsory minimum price-posting be enforced, and how many governmental employes would be added to the pay rolls before its complete failure would be demonstrated, as such plans have failed from the days of the Caesars to the present time?

How much would this experiment add to the consumer's cost? Why, if the retail merchants of petroleum products are so regulated, should not similar regulations be imposed upon other essential commodities, such as food, clothing and building materials? Who, under such a system, would be left for gainful employment to earn a living for the other half of the population and pay taxes to support government which, of necessity, never makes money but is today the greatest spender of the money earned or saved by its citizens?

Disintegration

Would it be any more in the public interest to disintegrate this industry than it would be to disintegrate the motor car industry and go back to the 1920 situation when motor cars cost twice as much as they do today and were not half as good. The petroleum and automobile industries are examples of what individual and group initiative under a free competitive system can accomplish. Would the substitution of political training and control for economic training and control have brought equally good results? Has it ever done so in the past? Do you believe it possible in the future, or do you believe that in the throttling of individual initiative, elimination of the profit motive and private management and the destruction of a free economy would lower the standards of living in our country as it has everywhere and every time it has ever been tried?

I do not know what the future holds for this nation, nor do I know anyone who does. The future will be determined, as it should be, by the people themselves. Their decisions are fraught with grave and early import, to themselves and to their children.

We know that our program so far has been achieved under a free economy, which has encouraged individual initiative, protected human liberty and respected private property. This is the capitalistic system as distinguished from the totalitarian, or socialized state, wherein a government decides what must be done by its citizens and with their lives and property. Put in another way, under the latter plan, the people exist to serve the state, instead of as under our historic system, the state existing to serve its people.

Industrial leaders are being called upon to save society. They cannot do that. Society must save itself and society may be trusted to make wise decisions only in so far as it is correctly informed. Industry owes it to the country and to itself to give the public the facts and to become more conscious of the human elements in the equation.

The petroleum industry has not failed in any public obligation in so far as its operations are concerned. It, like other successful enterprises, has been so immersed in its own problems that it has not paid enough attention to its public relations. These should be developed in every proper way. This, and other industries, might well consider means of getting the facts before the people.

In the language of the proverb—"Wisdom is the principal thing—therefore, get wisdom and with all thy getting, get *understanding*." In pondering this proverb, let us not neglect to first consider it in the light of our own conduct and our own relations to our country, and to our own fellowmen.

Society inevitably progresses or retrogresses. No person worthy of citizenship, and no person worthy of industrial or political leadership can for a moment desire anything but a constantly improving standard of living for all. Capital alone, in a modern state, makes employment possible. Labor is essential to the creation of capital. The combination creates wealth. When unwise laws, regulations and taxation so handicaps business, large or small, that it cannot create wealth, society ceases its forward march and falls into poverty and despair. If, as we believe, the outcome of these issues depends upon the breadth and depth of public understanding, American industry owes it to America to aid in that understanding.

MADISON

(Continued from Page 82)

since 1934" the price of regular gasoline had reached 5 cents, with Tulsa brokers "offering one-eighth below in effort to disrupt the efforts of the buying groups." Some gasoline was being sold for delivery to price-cutters, and the opinion was expressed that refiners were selling to price-cutters just enough "to keep the channels open in case buying movement is discontinued."

Fractional advances in gasoline, and "no surplus available in Mid-Continent" were the first news of April 17. No purchases had been made by the "buying group" for the past few days and none probably would be necessary for 10 days to maintain the market. There was hesitation to raise the tankcar price at the time because jobbers were not getting their 5½ cent margin. Only 20 out of 80 refiners were running because of difficulty in getting tenders. Effective April 12, Standard of Indiana was advancing all grades ⅝ of a cent.

April 24, advances in all markets ⅛ of a cent. No surplus in Mid-Continent. Surplus taken off market by "Globe, Skelly and ourselves."

May 9, gasoline continued firm in spite of inclement weather. Major prices in some instances exceeding those in Oilgram. "We are correcting our price to conform with Oilgram."

May 17, gasoline market in good shape. Buying group continues to move surplus.

The final witness of the week was Oscar L. Peterson, independent oil dealer of Evanston, Ill., who had testified early in the trial. His testimony tended to bear out the defense contention prices paid by the majors followed the journal quotations upward instead of setting the pace.

Peterson testified that out of approximately 1,000 cars of gasoline his company bought in 1935 and 1936 the greater portion was resold to jobbers on prices at the low or below the low of the Chicago Journal of Commerce.

From January, 1935, to March, 1936, he bought 588 cars from indepedents, of which 89 cars were sold above the journal low, 155 at the low and 339 below the low, while from April, 1935, to May, 1936, 336 cars were bought from Phillips Petroleum, of which 25 were sold at prices above the journal low, 281 at the low and 60 below the low. The tally for the entire amount was 149 cars sold above the low, 436 at the low and 399 below the low of the journal.

"So that most of your sales to jobbers were at or below the low of the journal during that period?" Colonel Donovan inquired.

"Yes," Peterson answered, adding that 76 cars sold to brokers were included in the list.

Asked how his volume of business in 1935 and 1936 compared with that of previous years, Peterson said it was "as good as in average years," and there were just as many jobbers in business during the period as in previous years, if not more.

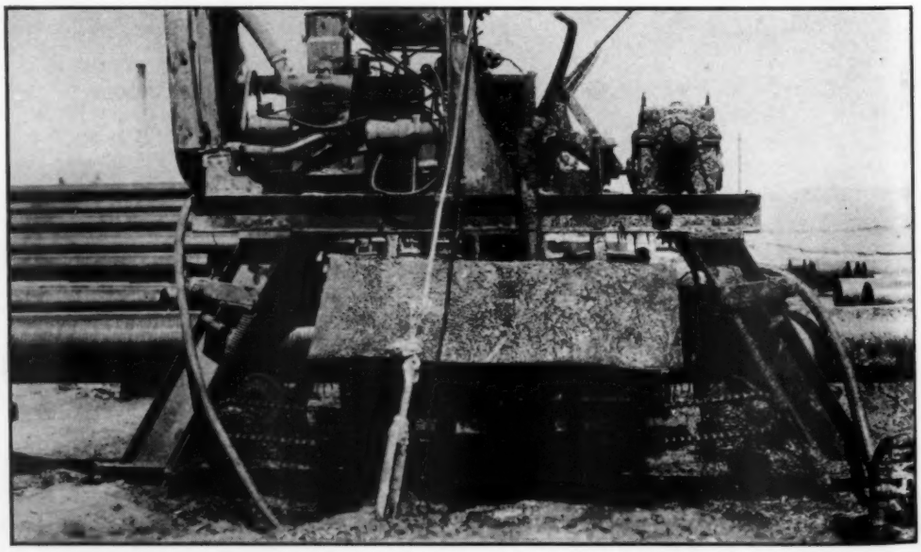
"Do you know what were the sources of the gasoline cars you bought from brokers?" Donovan asked, Peterson having testified that in addition to the purchases from 20 to 25 independent refiners and the Phillips Corp., he had bought 246 cars from brokers.

"I haven't the record of that with me," Peterson replied.

Just before court recessed for the week-end, Judge Stone announced he had "heard rumors" the government would complete its evidence in another week.

"We hope so," said Mr. Chaffetz.

C. H. Thigpen, of Shreveport, for nearly a year connected with the Shreveport office of the Louisiana department of conservation as a petroleum engineer, working in the Rodessa and Lisbon fields, has resigned to become associated with the Arkansas board of conservation. The board has assigned him to make bottom-hole and gas-oil ratio tests of wells in the Miller County area of the Rodessa field. He will have headquarters in El Dorado.



Stationary cleaning machine at yard. Note before and after cleaning; primed as cleaned

INTERNATIONAL

Anglo-Iranian Production

Anglo-Iranian Oil Co., Ltd., continued in August to set new production records in Iran. During the month, the company produced approximately 7,187,600 bbls., compared to 7,089,450 bbls. in July which itself was a record at the time. The production in August compared with the same month in 1936, shows a gain of about 1,668,550 bbls. or about 53,825 bbls. in daily average production.

For the eight months ended August 31, Iran crude oil production amounted to about 50,132,000 bbls., compared to 41,645,800 bbls. for the same period in 1936.

The production by months from January through August is shown below in units of tons which are converted to barrels by the factor of 7.55 bbls. per ton:

Month—	1937	1936
January	750,000	*668,000
February	631,000	*645,000
March	838,000	*669,000
April	824,000	616,000
May	827,000	768,000
June	879,000	723,000
July	939,000	696,000
August	952,000	731,000
Total	6,640,000	5,516,000

*Figures adjusted as of September 30.

U.S.S.R. Exports

Petroleum exports from U.S.S.R. fell to a new low mark during September totaling only about 372,000 bbls., compared to 690,000 bbls. the preceding month and with about 1,638,000 bbls. for the same month in 1936.

For the eight months ended September 30, U.S.S.R. petroleum exports totaled approximately 8,796,500 bbls., against 13,981,150 bbls. for the same period last year.

Heavy fuel oil and lubricating oil made up approximately 75 per cent of the petroleum exports. Germany, England, Japan and Siberia were the chief consumers. Lubricating oil shipments from U.S.S.R. in September were more than double those of fuel oil, probably the first time this relationship has existed since the early history of Russian refining.

Shipments from U.S.S.R. for September this year and last with accumulative totals for the nine months are shown in metric tons below:

	September		Nine months	
Products—	1936	1937	1936	1937
Lubricating oil	9,004	28,128	269,020	194,518
Fuel oil	137,054	13,375	967,903	606,026
Kerosene	33,328	1,445	249,538	132,764
Gasoline	53,930	10,185	503,862	323,332
Asphalt	692	.....	6,375	.....
Paraffin	.....	.....	608	.....
Total	234,008	53,133	1,997,307	1,256,630

Japanese Consumption

Japan proper consumed 10,993,265 bbls. of petroleum products for the first half of 1937, according to testimony given at hearings during a recent special session of the Diet, Japanese parliament. The consumption for Japan proper is considerably higher than previously reported. The only logical explanation United States trade attaches in Tokyo can assign is that the latest tabulations probably include material used by the government, whereas earlier statistics covered only commercial use.

Out of the total petroleum consumption for the first half of the year in Japan proper, 5,095,695 bbls. consisted of heavy fuel oil and 4,141,053 bbls. were gasoline. The remainder was divided about half to kerosene and neutral oil and the other half to light lubricating oil. Consumption statistics were also revealed for each of three years ending with 1936 covering the entire Japanese empire. There was an increase of more than 4,500,000 bbls. in total consumption in 1935 over 1934, but the increase for 1936 over 1935 was little more than 400,000 bbls. Indications are that 1937 consumption is far outstripping 1936 due probably in a large measure to the military operations in China. Petroleum consumption in Japan proper for the first half of 1937 is shown below:

Gasoline	4,141,058
Kerosene	481,163
Neutral oil	453,980
Machine oil	821,360
Heavy fuel oil	5,095,695
Total	10,993,265

Total consumption for the entire Japanese empire for 1936 follows:

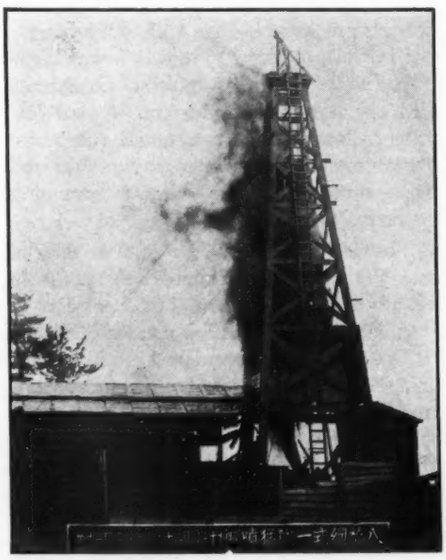
Gasoline	8,561,571
Kerosene	1,242,445
Neutral oil	887,813
Machine oil	1,932,868
Fuel oil	15,026,979
Total	27,651,676

Truce in Mexican Strikes

Pressure of a strained financial position has precipitated an agreement between Mexican oil producers and the government to abolish further strikes, unless all peaceful means of a solution have been exhausted, until end of the year.

The agreement, a temporary stopgap in President Lazaro Cardenas' efforts to improve financial position of the government, has nothing to do with the settlement of the wage conflict now before the Federal Labor Board. Because of the rapid fall of the Bank of Mexico reserves and the lack of ready cash, the government feels it is necessary to avoid all strikes which might cut into revenue.

The government also called off the electric light strike and has sent troops to assure no immediate strike against United States mining interests in the northern states of Mexico. The government action in taking a stand against strikes for the present is regarded as a moratorium on the campaign against foreign companies which has been tolerated and encouraged by the administration for months.



Oil well in Yabase field near Akita, where developments in past three years accounted for much of the increase in Japan's output

Jersey French Affiliates

The major part of Standard Oil Co. (New Jersey) distribution and refining in France has been brought under the control of one concern, Standard Francaise des Petroles, S.A., by a step in reorganization approved by shareholders in Campaigne Standard Franco-Americaine on October 20. Liquidation of Campaigne Standard Franco-Americaine, due for completion about the end of the current year, will result in United Petroleum Securities Corp. gaining control of about 83.5 per cent interest in Standard Francaise des Petroles, S.A.

The changes now under way will leave only three French companies affiliated with Standard Oil Co. (New Jersey) under separate operation, a shipping company, Societe Auxiliare de Transport; Quervel, a lubricating company and a general distributing company in the south of France, Compaigne Generale de Petroles.

In further simplification of its foreign operating set-up, Standard Oil Co. (New Jersey) has accepted delivery on five divisions of West India Oil Co. Shares of the following West India companies have been delivered to Standard (New Jersey): West India Oil Co., Sociedad Anonima Petrolera Argentina; Sociedad Anonima Uruguaya; West India Oil Co., Chile, S. A. Commercial; West India Oil Co., (P.R.) and West India Oil Co., S.A.

Drilling in Britain

D'Arcy Exploration Co., subsidiary of Anglo-Iranian Oil Co., is in process of drilling three wildcat tests on British soil. The Kingsclere test, near Newbury, is proceeding below 3,315 feet and the D'Arcy company's test at Eskdale, near Whitby, is proceeding below 1,650 feet.

At Cousland, near Dalkeith, in Scotland, the D'Arcy company's test is drilling at about 500 feet in shale. It is near an old hole drilled during and immediately after the war by S. Pearson & Sons which at 1,810 feet produced about 450 bbls. of oil during a long test period, but did not reach commercial proportions and the condition of the hole did not warrant deeper drilling.

During the war drilling campaign, 1918-21, 11 tests were drilled on locations selected after careful geological study. In each case the objective was carboniferous oil. Seven wells were drilled in Derbyshire, two in Staffordshire, and two in the midland valley of Scotland. The first, on the crest of the Hardstoft anticline, found oil at 3,077 feet. This well produced its peak output of 370 tons in 1920 and still yields about 50 tons annually. None of the other wells gave any appreciable production of oil, though showings of both oil and gas were found in several Derbyshire holes and in the D'Arcy (name of a town in Scotland) and West Calder tests in Scotland.

Bachaquero District

Venezuela Oil Concessions, Ltd., Shell subsidiary operating in Venezuela, is building a dyke along the Lake Maracaibo shore in the Bachaquero district south of the Lagunillas field, preparatory to launching a development plan. Involved in the preparations is a series of drainage ditches or canals for removal of water during the rainy season. While removed from the Lake Maracaibo shore line, Venezuela Oil Concessions acreage in the Bachaquero district is mostly lower than the lake's water level and is subject to submersion part of the year.

15 MINUTES

"SUGGESTIONS for governmental regulation do not come from the consumers of petroleum products," said President Byles. "In view of the prices they are paying and the service rendered this is quite understandable." Discussing marketing operations and the degree to which manufacturers have withdrawn from that field, Mr. Byles said a small minority who for one reason or another are unsuccessful or dissatisfied have not only turned upon their suppliers, but are appealing to the government.

"In these days, when many uncomplimentary things are being said about American industry, it might be permissible to say that you gentlemen are rendering increasingly commendable public service. This is so when measured by quality, quantity, price and distribution of your products, wages and working conditions of employes and during the last year an approach toward a more reasonable return on invested capital, notwithstanding increasing costs of finding and producing petroleum from deeper levels and increased cost of materials and supplies." The public would appreciate these services if it understood them, Mr. Byles added.

Trends in the Industry

Interesting analyses of oil developments along a wide front were contributed by George A. Hill, Jr., who declared thoughtful men in our industry should have periods of lucid detachment notwithstanding the "vexations of the times, international unsettlement and the complexities of our business." Among conclusions drawn by Mr. Hill from recognizable trends and a critical study of them were these:

"Private capital, individual initiative and free competitive enterprise have achieved the highest degree of development in exploration, exploitation and in the advancement of each of the associated sciences involved in petroleum technological progress, which have resulted in cheaper prices to the consuming public.

"National defense and national welfare are best promoted and served by the extensive and efficient development of petroleum (an indispensable weapon of national defense) through the medium of private capital, initiative and management in a free competitive system, susceptible of quick mobilization for emergent national service."

Standard Oil Co. of Indiana received the Institute's all-department certificate for progress in accident prevention. The company had 4.11 disabling injuries per 1,000,000 hours worked and 0.96 day lost per 1,000 hours worked. Departmental certificates were awarded to several companies.

Reelection of Axtell J. Byles as president of the Institute and of W. R. Boyd, Jr., executive vice president by new board of directors is assured.

The board of directors passed a resolution prohibiting further increases in the board membership. A committee of seven is to be appointed by the president to make a recommendation as to the desired number for the board which now has more than 100 members.

Registrations indicated that approximately 3,000 are in attendance at the meeting.

Production

The oil-field emulsion problem can be minimized through reduction of agitation often caused by leaky pumps; producing physicochemical conditions unsuitable for emulsion formations and the separation of the water from the oil before agitation takes place. Origin of the emulsions are: Well pumps, tubing, flow lines and transfer pumps. It is suggested that a detailed study of the possibilities of prevention as well as cures will result in substantial savings to operators and pipe line companies.

Pumping

A study of pumping conditions in the Oklahoma City field results in the general conclusion there is little difference in cost per barrel produced by the different methods. The investigators found that hydraulic and sucker-rod pumping compete at low rates of flow with the centrifugal pump best at high rates. They cite the advantages and disadvantages of the various pumping methods.

Savings are claimed for field welding of casing due to the lower cost of casing. Steels having a carbon content of 0.35 per cent is considered top and A.P.I. grades "C" and "D" steels are not considered readily weldable. A trained personnel and considerable auxiliary equipment are required to carry on successfully a field welding job. Time is saved with bell-and-spigot pipe over butt-joint pipe.

Control of the gas-oil ratio is primarily a question of preventing withdrawal of free gas from the pay formation. Proration was credited with being the foremost single factor in proper utilization of gas energy in oil fields. Possibilities of lowering production costs by maintaining a minimum ratio between the quantity of gas and oil produced were described.

With a view of removing vagueness in oil-production terminology a compilation of definite terms for use in measuring and calculating oil-well performance was recommended.

Proper maintenance of gas engines used on pumping wells and otherwise results in longer life, reduced unit costs, less shutdown time and lower production losses.

Proper functioning of screen casing materially affects the pressure gradient in the immediate vicinity of the well and controls the production of sand with the oil.

Refining

A total of 251 Pawhuska, Okla., road tests conducted by Western Petroleum Refiners Association and Natural Gasoline Association of America this year showed that it is not sufficient that automobile engines give trouble-free operation. In some cases this presumably satisfactory operation is being obtained through removal of light ends at the carburetor with a resulting loss in mileage per gallon and octane rating. The tests showed volumetric losses of fuel varying from 4 per cent upward, depending upon driving conditions with representative cars. The over-all loss in antiknock rating was at least one octane number.

In these tests, four procedures for arriving at permissible vapor pressures were studied. Nine conclusions were reached based on data covering permissible vapor pressure vs. atmospheric-temperature data on nine cars and volumetric-loss data on six cars.

Demand for domestic fuel oils has increased 10 times as fast as gasoline since 1930 and 103 per cent gain in the number of oil burner installations. Demand for these and other fuels is bringing about important changes in refinery operations. Analyses of the various classes of outlets for residual fuels and overhead distillates show that most of them are expanding.

Position of these oil fuels in competition with coal, natural gas and other fuels is

WITH THE A.P.I.

sound and continued expansion is predicted for the future. The number of grades of fuel oil delivered by tank-wagon should be reduced to a minimum. It is claimed that it would be possible to operate 350 different makes and models of domestic oil burners on two primary grades of domestic fuel oil. One grade would serve burners operating automatically and another the industrial demand.

Isooctane

Growing importance of isooctane was indicated in fact that one entire session of refining division was devoted to recent developments in its manufacture and utilization. Isooctane is a broad term applied to a series of octanes found in petroleum having a boiling range from 200° to 260° F. The development of polymerization has greatly aided refiners to meet demands of the automotive and aircraft industries for high octane motor fuels, it being estimated that over 1,000,000,000 gallons of isooctane fuel of 95 to 100 octane rating are available from hydrocarbon gases produced in the United States each year. Of this potential volume, however, only a small fraction is being produced at this time, the United States aviation forces and commercial air transportation consuming the major portion of the present output.

Three papers were presented on this subject, one dealing with the polymerization of isooctane from isobutylenes using hot sulfuric acid as a catalyst; another on the present high octane motor fuels being produced through use of the polymerization process, and a third in which aircraft operations with fuels of 100 octane number and higher were discussed.

Since commercial isooctane has a narrow boiling point range, it must be blended with other polymer liquids, straightrun gasoline or natural gasoline before it is used as a motor fuel. Thus a typical commercial aviation gasoline of 100 octane number may contain approximately 50 per cent isooctane. At present air transportation companies are using a fuel of around 87 octane for cruising and a 100 octane or higher fuel for warm up and take off. However, if 100 octane fuel were used in place of the 87 octane fuel, it was pointed out that power would be increased up to 30 per cent, cruising fuel consumption would be reduced by 10 to 15 per cent, and a cruising fuel economy closely comparable with that of a compression-ignition engine would be attained.

Changing Demand

In the manufacture of isooctane from isobutylenes it was pointed out that by use of hot sulfuric acid in place of cold sulfuric acid, almost double the yield of octenes was obtained from the same fuel stock and these, when hydrogenated, had an octane number nearly equivalent to that of pure isooctane. The process, which is now in commercial operation, will therefore be of great value in meeting the increasing demand for polymers of 98 to 100 octane number.

The higher the altitude the lower the octane requirements to prevent knocking in modern motors. Twelve 1937-model automobiles were used in making tests at sea level and in the mountains. Lower octane rating, thinner air-fuel mixtures and smaller carburetor jets can be used at the higher levels. The rate of decrease in octane requirements ranges from about 3 octane units per thousand feet at sea level to about 7.5 units at 12,000 feet. On the western plains, where the altitude exceeds 4,000 feet, average cars can use gasolines of at least 10 octane units lower value than at sea level.

Airplane speeds up to 500 miles per hour due to development of high-octane gasoline were predicted. The cost of 100-octane gasoline has been reduced from $20 per gallon a few years ago to 50 cents a gallon.

Transportation

Ill-advised legislation designed to regulate motor trucks not only handicaps operations, but contributes nothing to public welfare and creates barriers to progress. Ordinances and orders should present clear statements of the ends to be accomplished, rather than involved details. Uniformity of laws and regulations is desirable, but should not be carried to extremes which prevent adaptability to local conditions.

Unreasonable and conflicting regulations laid down by various governmental bodies are causing concern to truck-tank manufacturers. "Fast and furious changes" in municipal regulations, unreasonable rules, inconsistencies in the present National Fire Protective Association regulations and absence of uniformity in state laws are creating pressing problems. Study by special committee urged.

The board of directors adopted a resolution toward the promotion of highway safety having the effect of establishing minimum standards for automotive tank vehicles and urged acceptance of standards approved by National Fire Protection Association.

Research

The fact that it would have required 3,607,000,000 barrels of crude oil in 1936 instead 1,742,000,000 barrels to supply the motor fuel requirements in the United States, had it not been for the development of the art of cracking in refinery operation was pointed to by Dr. H. E. Howe as indicating the practical significance of petroleum research.

The veteran editor of Industrial and Engineering Chemistry in a detailed discussion of petroleum research to date stressed the fact that the production of solvents and many other chemicals from petroleum as the raw material has just been touched. He pointed to the thriving industries founded on ethylene and the pentane fraction from gas as indicating the possibilities of the chemical field.

"More recently," Dr. Howe pointed out, "the petroleum industry has developed viscous oils and rubber-like products from the gaseous hydrocarbons. These polymers have material resistance to acids, alkalis weathering, and ageing; and may be used as coating for all sorts of base materials. They are found useful in rubber compounds, improving the latter in many respects. There has also been made available a variety of synthetic resins made from oxidized hydrocarbons."

Twenty gallons of Mid-Continent "straightrun gasoline, worth $1.00 at refineries, have a potential value of $1,000 in terms of the amount of five normal paraffin hydrocarbons — n-hexane to n-decane — which can be separated from it, Dr. Frederick D. Rossini of the Bureau of Standards said in his 20,000-word paper on the chemical constitution of petroleum. He explained that when existing laboratory methods of separating these hydrocarbons have been per-

The material in this summary was prepared by the following members of the Journal's editorial staff: C. O. Willson, W. T. Ziegenhain, Dr. C. K. Francis, L. G. E. Bignell.

fected on a commercial basis the cost of production will be less than other existing processes.

Dr. Rossini listed a large number of products now being used by the petroleum chemical industry and these can be "enormously" increased when hydrocarbons of higher molecular weight (six or more carbon atoms) are commercially separated from petroleum.

The "nitrogen-reduction ratio," explained by Dr. Trask, offers possibilities of determining what source materials contain oil. Ten years have been devoted to search for the "mother of petroleum," the source rocks or sediments from which oil may be obtained. Research workers have tested 30,000 samples of rock cuttings and 2,000 samples of sediments from throughout the world. No trace of petroleum was found in sediments from the bottoms of the seven seas, indicating oil was formed millions of years after the sediments were deposited. "The sediments in practically every known oil field are at least 10,000,000 years old and in some fields 300,000,000 years old." The suggested method of ascertaining the presence of oil in advance of geophysical prospecting or drilling appears to be 65 to 75 per cent efficient. The industry has spent an estimated $800,000,000 drilling dry holes in the past 10 years. The new method of determining source beds should decrease prospecting and producing costs and permit source beds in new territory to be accepted or rejected on the basis of scientific findings before geophysical prospecting or drilling is done.

Public Relations

Preliminary plans to bring the story of the petroleum industry to the millions who will attend the World Fair in New York City in 1939 were outlined at the meeting of the advisory committee on public relations. The New York exhibit, sponsored by 13 oil companies, will keep away from product advertising and present the accomplishments of the entire industry. An oil exhibit to be held at the San Francisco show the same year will be conducted along similar lines.

Committees

Several days previous to the convention proper more than 40 committees met to discuss production practices and more than 20 committees met to discuss refinery problems. In practically all instances these were well attended and there was more than the usual amount of discussion. Manufacturers committees offered guidance in many of the engineering problems which involved equipment.

Among the list of standardization meetings which prompted an exceptionally large attendance was that on oil country tubular goods. Here thread tolerance was a principal subject for discussion. A revision of the present tolerance limits was suggested and arguments for and against the round and sharp edges on the threads were presented. Much of this discussion involved data derived from tests the Institute has had under way in Pittsburgh. Since rounded threads would require the use of different gauges than are now used, the Institute has been investigating the design and accuracy of such gauges, for use if and when they are needed. The progress in this work was reported. A detailed summary of revisions in the specified physical properties of certain tubular goods was also presented, no action on any specific possible revision was taken. Since this work influences the setting depths, particularly of casing, a review of the setting data was made.

Other subjects reported included hydrostatic tests and impact tests on tubular goods, the tendency being to make the specifications a little more exacting. Alignment tolerance specifications for welded pipe lines which would call for a more exacting pipe diameter brought forth much comment. Such subjects as inspecting the pipe, the expense of testing the pipe to the point of destruction, the various types of valves to be used and the disposal of imperfect pipe sections were subjects which offered the greatest amount of discussion.

A group of refinery executives met to discuss the adjustment of stated refining capacities. It is well recognized that in many instances stated refining capacities expressed as barrels of crude which may be processed daily are in excess of the volume which could be processed completely to make modern motor fuels and lubricants. An effort is being made to establish a basis for judging refining capacity along the more modern lines.

The C.F.R. committee submitted reports covering in detail both laboratory and road test work in determining antiknock ratings of motor fuels. No attempts were made in the report to correlate the results of the two investigations.

Rotary Drilling

That portion of the production meetings which dealt with rotary drilling revealed that oil company engineers were seeking greater flexibility in the choice of rotary equipment. This has been considered necessary to enable them to meet a broader variety of drilling requirements. The manufacturers pointed out the advantages of further simplification and standardization. No specific action was taken. Involved particularly in this work are the design of rig irons, derricks and tools and reports on the progress toward complete perfection in the standardization of these were presented.

In the series of committee meetings held to discuss problems inherent in refining the disposal of refinery wastes, particularly gases and vapors, was discussed. Progress was reported in the standardizing of certain refinery equipment. Closely allied with this has been the Institute's work in identifying the causes for refinery corrosion and on this a progress report on work being undertaken in East Coast refineries was presented.

The committee on fire prevention accepted the draft on a code to be distributed by the Institute which will bear the subject "Fire Prevention in Refineries."

The committees representing the natural gas and natural gasoline industries were also busy and each offered for final acceptance by the central committee a code to standardize methods of measuring, sampling and testing gas and natural gasoline.

The transportation division of the industry has its problems and one action taken which is of unusual importance to refiners and tankcar fleet owners is the recommended extension from January 1, 1938, until July 1, 1938, of the requirement that all railroad cars be equipped with cast steel side frames on the trucks. This requirement had been postponed previously and considerable discussion resulted when a further delay in its effective date was asked.

Bolted tank manufacturers adopted standardized specifications for steel stairways and walkways.

Suppliers

John M. Crawford, chairman, Parkersburg Rig & Reel Co., Parkersburg, W. Va., was elected president of the Petroleum Equipment Suppliers Association. He succeeds W. J. Morris, Continental Supply Co., Dallas, Tex. John L. Shakely, vice president, Frick-Reid Supply Corp., Tulsa, is the new vice president, and Wharton Weems, attorney, was renamed secretary-treasurer and counsel.

New directors are:

Eastern—Percy C. Jones, J. A. Geismar, F. F. Murray, J. M. Crawford, Donald Mackie and Jerry McJerkins.

Mid-Continent—W. M. Bovaird, J. L. Shakely, J. A. Chapman, D. R. Brown, Earl W. Miller, and A. A. Moody.

Southwestern—W. J. Morris, S. R. Bray, J. T. Crotty, T. T. Word, and E. W. Gildart.

California—F. C. Merritt, E. S. Dulin, D. S. Faulkner, L. H. Keim, E. M. Smith, J. A. Crowder, L. F. Baash, and J. C. Axelson.

A.P.I. Papers and Authors

President's Address, AXTELL J. BYLES, President, American Petroleum Institute.

Trends in Petroleum Industry, GEORGE A. HILL, JR., Houston Oil Co. of Texas.

Address, J. D. COLLETT, O'Keefe and Collett.

Address, HON. WESLEY E. DISNEY, Member of Congress.

TRANSPORTATION

Truck Tank Manufacturers' Problems in Designing and Building Delivery Equipment for the Petroleum Industry, J. E. JULIAN, National Truck Tank Association.

Problems in Operating Truck Tanks, J. W. SINCLAIR, Union Oil Co. of California.

PRODUCTION

Prevention of Oil-Field Emulsions, J. S. SURFLUH, Standard Oil Co. of California.

Oklahoma City Field Pumping, B. M. MORONEY, Carter Oil Co., and F. R. WHEELER, Barnsdall Oil Co.

Gas-Oil Ratio Control in Flowing Wells, R. J. SULLIVAN, Carter Oil Co.

Oil-Well Performance: A Discussion and Proposed Terminology, B. P. KANTZER and E. G. TROSTEL, Union Oil Co. of California.

Operation and Maintenance of Multi-Cylinder Gas Engines, H. R. HOGABOOM, Petroleum Equipment Co.

Selection of Screen Openings for Unconsolidated Sands, C. J. COBERLY, Kobe, Inc.

Circumferential Field Welding of Casing, L. R. HODELL, Carter Oil Co.

REFINING

Fuel-Oil Production and Use—Present Status and Future Outlook of Supply of Domestic and Industrial Fuel Oils in the United States, R. T. GOODWIN, Shell Union Oil Corp.

Influence of Fuel Characteristics on High-Speed Diesel Performance, G. A. HOPE and W. S. MOUNT, Socony-Vacuum Oil Co., Inc.

Motor Fuels From Polymerization, GUSTAV EGLOFF, J. C. MORRELL and E. F. NELSON, Universal Oil Products Co.

The Catalytic Polymerization of Butylenes by Sulfuric Acid, S. H. McALLISTER, Shell Development Co.

Aircraft Operation With Fuels of 100-Octane Number and Higher, S. D. HERON, Ethyl Gasoline Corp.

C.F.R. Reports Covering Road Knock Tests and Laboratory Knock-Test Procedure.

Fuel Systems of 1937 Automobiles, T. W. LEGATSKI and R. R. COUCH, Phillips Petroleum Co.

Effect of Altitude on Anti-Knock Requirements of Cars, NEIL MacCOULL, K. L. HOLLISTER, and R. C. CRONE, Texas Co.

RESEARCH

The Significance of Petroleum Research—Its Value to the Public, Its Necessity to the Industry, DR. H. E. HOWE, "Industrial and Engineering Chemistry."

One Way of Finding Oil More Cheaply—A.P.I. Research Project 4, PARKER D. TRASK, U. S. Geological Survey.

A Decade of Research on the Chemical Constitution of Petroleum, FREDERICK ROSSINI, National Bureau of Standards.

American Petroleum Industries Committee Gets Results

The American Petroleum Industries Committee was formed about four years ago to oppose adoption of discriminatory taxation and restrictive legislation which affected the petroleum industry and its customers, and to seek relief for these groups from existing unduly burdensome taxes and restrictions. These needs, with the added necessity for combating evasion of gasoline taxes, were compelling motives for the creation of the organization.

The committee at the time of its formation outlined the following policies:

1. To give aid to the strengthening of all state gasoline tax laws, so that evasion of taxes and substitutions may be prevented.
2. To oppose further increases in gasoline taxes.
3. To adhere to the principle that funds derived from gasoline taxes should be spent only for highway construction and maintenance.
4. To advocate reduction of gasoline taxes that are disproportionately high.
5. To oppose unreasonable restrictions upon the operation of motor vehicles.
6. To urge that taxation of petroleum products be left solely to the states.
7. To oppose all legislation inimical to the best interests of the petroleum industry and the highway users of each state.
8. To combat gasoline tax evasion by coordinating the committee's efforts with those of state and county tax collection officials or with whatever other agencies are concerned with this problem.
9. To adopt a program of public relations which will assist in fostering and securing the legislative objectives outlined.

To carry the program into effect an organization plan was developed to enlist the cooperation and support of the entire manpower of the petroleum industry. The organization plan, moreover, was divided according to the various governmental units—national, state, county, and city.

BAIRD H. MARKHAM

Baird H. Markham was selected as director. The members of the committee appointed by the board of directors of the American Petroleum Institute, and reappointed for 1936 and 1937, are:

Harry T. Klein, Texas Co., New York (chairman).

James J. Cosgrove, Continental Oil Co., Ponca City, Okla.

Paul M. Gregg, Union Oil Co. of California, Los Angeles.

W. J. Guthrie, Gulf Refining Co., Pittsburgh, Pa.

Edwin S. Hall, Standard Oil Co. of New Jersey, New York (secretary).

George V. Holton, Socony-Vacuum Oil Co., Inc., New York.

William A. McAfee, Standard Oil Co. of Ohio, Cleveland, Ohio.

Roy T. Osborn, Sinclair Refining Co., New York.

Subcommittees

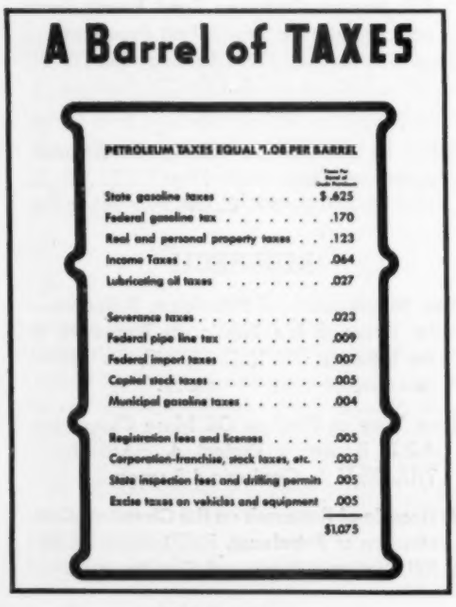
The following subcommittees were also organized: Alcohol-gasoline, chain store taxation, constitution and by-laws, division and state budgets, federal revenue taxation, finances and contributions, gasoline taxation, gasoline tax evasion and substitutions, highway users conference, local miscellaneous taxation, manufacturers sales tax, motor vehicle legislation and uniform gasoline tax law. The country was also mapped into divisions and committees appointed for each division: Central, Pacific Coast, Rocky Mountain, Southern, Eastern, Northeastern and Southwestern.

During the four years the public relations section has sent out press releases setting forth many salient facts to educate the public as to the actual conditions under which it has been operating automobiles and to arouse interest in bringing about lower taxation. These efforts have shown results but there is much remains to be done. The prime objective is gasoline tax reduction which is practicable as shown by the following data compiled by the Industries Committee:

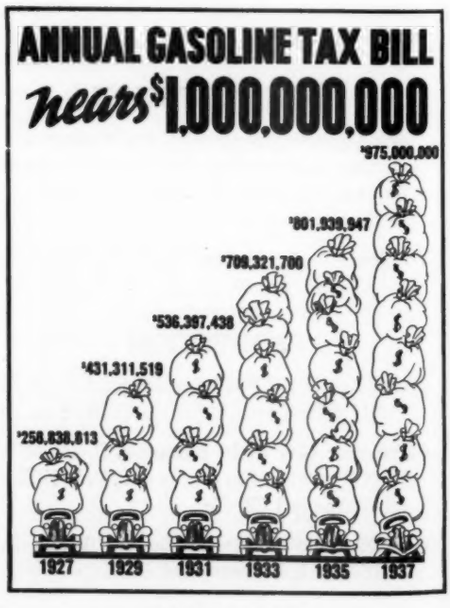
State gasoline tax rates could be reduced on the average by approximately 1 cent and still yield the same amount of revenue as in 1934.

Gasoline tax collections for each 1 cent of rate has gradually climbed since 1934 until now it exceeds $190,000,000. The yield of each cent of rate was chosen because it eliminates variation in collections resulting from rate fluctuations. Because the effect of rate changes have been removed, the marked uptrend is largely attributable to the more widespread use of automobiles.

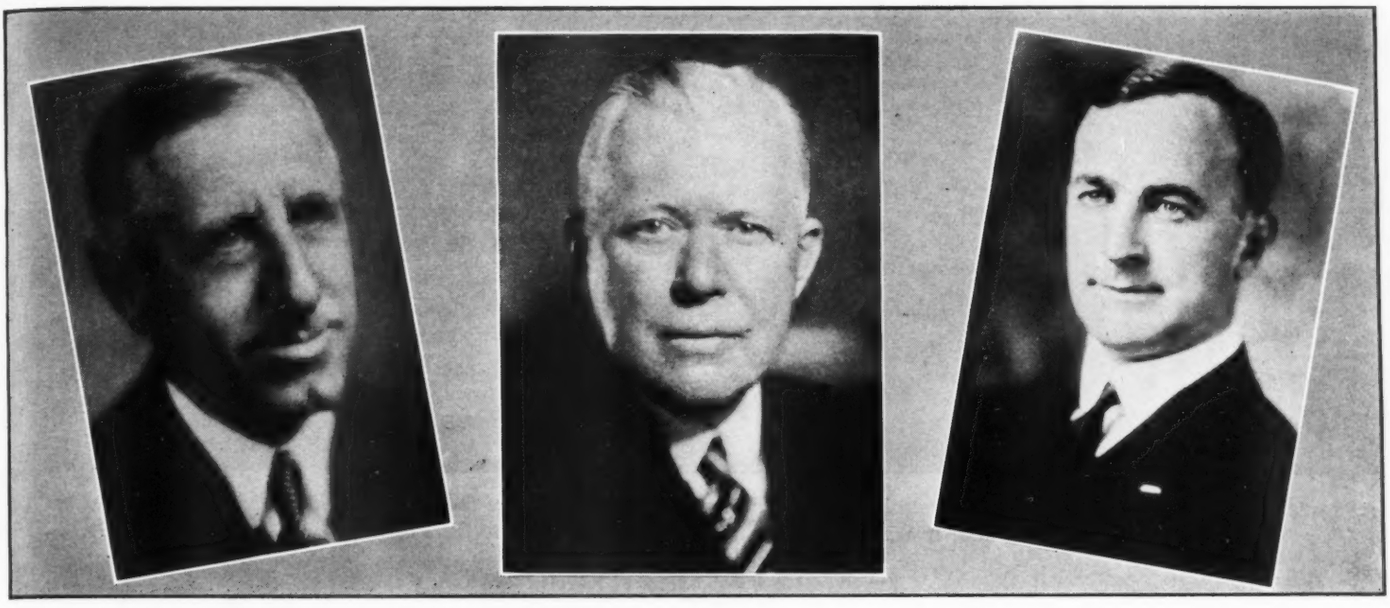
This increased productivity of state gasoline taxes emphasizes the case for an immediate reduction in present excessive gasoline tax rates. Rates were increased during the depression supposedly to offset the slight decline in revenue yield. Although collections now far exceed their pre-depression levels, the emergency rates are still in effect. They are not required to finance the highways because nearly 18 cents out of every gasoline tax dollar is used for other purposes.


A Barrel of TAXES
PETROLEUM TAXES EQUAL $1.08 PER BARREL
State gasoline taxes . . . . . $ .625
Federal gasoline tax 170
Real and personal property taxes . . .123
Income Taxes 064
Lubricating oil taxes 027
Severance taxes 023
Federal pipe line tax 009
Federal import taxes 007
Capital stock taxes 005
Municipal gasoline taxes 004
Registration fees and licenses 005
Corporation-franchise, stock taxes, etc. . .003
State inspection fees and drilling permits .005
Excise taxes on vehicles and equipment .005
$1.075

A.P.I.C. cartoon



A.P.I.C. cartoon



P. M. GREGG *W. G. GUTHRIE* *H. T. KLEIN*

In time of fiscal need the motorist taxpayers assumed a disproportionate share of the tax burden. Now they are certainly entitled to relief through gasoline tax reductions. In many states such reductions are clearly practicable.

	Actual weighted average state gasoline tax rate	Total state collections	Collections per 1 cent of tax	Average rate required to maintain 1934 collections
1934	3.66c	$591,995,000	$161,747,267	3.66c
1935	3.8	616,852,000	162,329,412	3.64
1936	3.85	686,631,000	178,345,714	3.32
1937	*3.95	*766,594,000	194,074,430	3.05

*Estimated.

That these taxes fall heavily upon the average wage earner is clearly shown in the following study made by this committee.

Automobile ownership among families with incomes of $30 a week or less is expanding by 1,000,000 a year, and by 1940 close to 15,000,000 families in modest or low income groups will be owners of motor vehicles if the present trend continues. Two-thirds of the cars in this country by 1940 will be owned by families having incomes of $30 a week or less, and only one-third of the car-owning families will fall in the income class above $30 a week, Baird H. Markham, director of the American Petroleum Industries Committee, asserted at an interstate conference on gasoline taxation held in Chicago, Ill.

"Less than half of the motorists in the United States have ever purchased a new car. You will probably be surprised to know that during the past 10 years the sales of used cars, chiefly to our hypothetical 'typical motorists,' have greatly exceeded the sales of new cars. In 1936 a total of 4,016,000 new motor vehicles were sold in the United States. But sales of used cars were more than 50 per cent higher, reaching a total of 6,590,000. The market for inexpensive used cars in the United States is far larger than the market for new cars because the majority of motorists today have incomes in the lower brackets.

"Despite these facts which show conclusively that the bulk of our motor vehicle owners have small ability to pay taxes, the tax burden on the motorists has been increased continuously by the federal and state governments. Fifteen years ago, for example, the average annual gasoline tax bill per motor vehicle was only about $5; now it is above $30. This year the state and the federal governments will collect close to $1,000,000,000 in gasoline taxes from the highway users of the country, who will also pay about one-third of $1,000,000,000 to the states in registration fees. Hundreds of millions of those dollars collected, allegedly as road tolls, will be misappropriated by diversion to non-highway purposes, or unwisely spent because of an over-abundance of tax funds.

"Excessive taxation of motorists, most of whom have small or modest incomes, runs counter to the principles of true democracy. Our government should aim to bring, through its taxation policies, the greatest good to the greatest number. It should strive to foster the distribution of the fruits of American inventiveness and modern business organization to that strata of our population with low incomes."

G. V. HOLTON *ROY T. OSBORN* *J. J. COSGROVE*

Architect's drawing of the new International Petroleum Exposition exhibit building, one of the 10 new buildings to be constructed for the Tenth International Exposition in Tulsa, May 14 to 21, 1938

New Building Program Under Way for Tulsa Exposition

Three announcements of interest to exhibitors and those who will attend the International Petroleum Exposition at Tulsa May 14 to 21 next, will be made at the A.P.I. convention at Chicago by W. G. Skelly, president of the exposition.

The executive committee has authorized the construction of a new exhibit building, 380 feet long by 60 feet wide, containing 128 additional 10 by 10-foot booths.

Dr. Gustav Egloff, internationally known scientist, director of research for Universal Oil Products Co., has accepted the chairmanship of the International Petroleum Exposition's Scientific and Technical Committee.

A $250,000 building program, consisting of the new exhibit building, new cafeteria, enlarged office building, and seven new buildings to be constructed by individual exhibitors, is already underway for the 1938 International Petroleum Exposition. Announcement of other buildings by individual exhibitors is expected shortly.

The new exhibit building will have a modernistic front and will be constructed adjacent to the grounds. "It is necessitated," according to General Manager William B. Way, "because of the heavy reservation which already has totaled more than that taken at the 1936 exposition." The exposition had previously added 40 per cent greater outside exhibit space, which is about 95 per cent sold out at this time.

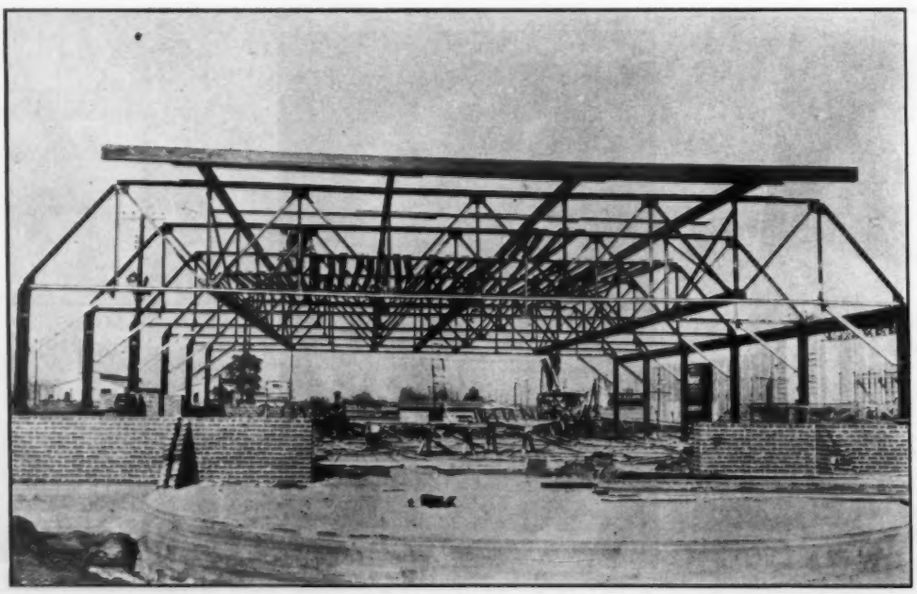
"The scientific and technical exhibits, worked out under the direction of Dr. Egloff, will be more extensive and larger than at previous expositions. A Hall of Science, which will be the beginning of a permanent display, is one of the objectives of the committee. A building with three times the space heretofore used is being provided for the scientific and technical exhibits this year."

Dr. C. K. Francis, technical editor of The Oil and Gas Journal, is vice chairman of the committee and serving with him on the executive committee are: W. A. Schlueter, president of Refinery Supply Co.; L. S. Gregory, L. S. Gregory Co.; B. W. Logue, chief chemist of the Texas Co. refinery at Tulsa; and R. L. Ginter of Ginter Chemical Laboratory. Other members of the executive and general committees are to be appointed later.

Manager Way said the new building program would be the largest in the history of the exposition since the major portion of the plant was completed. The new cafeteria building, announced several months ago, is well under way, with the steel girders in place and the brick work started.

Expanded exhibits will call for greater service to the exhibitors and the exposition is planning to enlarge its office facilities, said the general manager. The structure will be a two-story building, with some offices on the second floor. A directors meeting room and larger lobby for exhibitors will be included. The building will contain 50 per cent greater space than the present structure.

President Skelly is also formally presenting an invitation to the A.P.I. at the Chicago meeting to hold its semiannual meeting in Tulsa next spring in conjunction with the exposition.



Modernistic, air-cooled cafeteria building under construction on the grounds of the International Petroleum Exposition, Tulsa, in preparation for the May 14 to 21, 1938, oil show

Prevention of Oil-field Emulsions

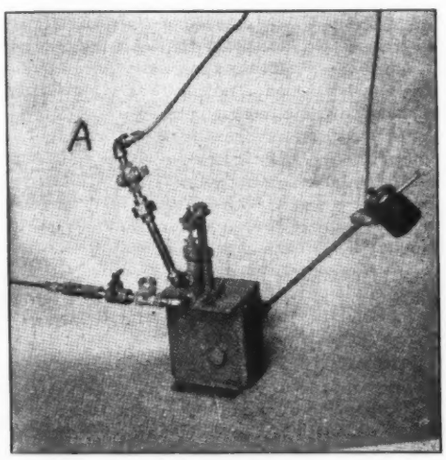
By J. S. SURFLUH
Standard Oil Co. of California, Los Angeles, Calif.

The art of treating oil-field emulsions has been well developed, but still more effective results can be expected by eliminating the formation of emulsions to as great an extent as possible. The prevention of oil-field emulsions is now receiving more attention, but there is still much progress to be made. Dehydration is often one of the principal items of lifting cost; and, whenever this is true, the important subject of prevention should receive special attention.

It is the purpose of this paper to present practical results accomplished in California oil-field practice. Theoretical discussion will be made as brief as possible, inasmuch as this phase has been adequately covered.

The Causes of Emulsions

The well-known cause of oil-field emulsion is the agitation of oil and water in the presence of



Simple reciprocating pump used for injecting chemical.
Figure 1

emulsifying agents. The permanency of the emulsion is dependent upon the severity of the agitation and upon the emulsifying agents[1a] present. In many instances a great deal of violent agitation is required to produce stable emulsion. In other cases, it is necessary only to stir the oil and water for a few moments to produce stable emulsions. In the latter case there are certain emulsifying agents present which aid the production of emulsions greatly. Oils which have been exposed to the weather, as in sumps, fall into the latter class.

Emulsions are classified as permanent and temporary. A temporary emulsion will break down into oil and water by settling methods alone.

Any method of preventing the formation of emulsions in oil and water mixtures must either reduce the degree of agitation or must employ the use of chemicals[2] to produce physicochemical changes which will aid in emulsion prevention.

The separation of all of the water from the oil before the mixture has been agitated severely is a third possibility which can occasionally be used.

Sources of Emulsions and Their Prevention

Possible sources of oil field emulsions and their respective remedies can be classified as follows:

Turbulence in Formation

There is no conclusive evidence available to prove that emulsions are produced in the formation; therefore, no additional discussion will be given.

Oil-Well Pumps

From operating data, we conclude that oil-well pumps in perfect condition will produce some

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

emulsion, provided the oil and water pumped can be emulsified readily; however, the quantity of emulsion produced is usually small until the pump becomes worn. When the oil-well pump becomes worn, the emulsion content of the oil increases greatly. Our knowledge of emulsions makes it evident that anything which will reduce the turbulence in the pump will aid in the elimination of emulsions; therefore, the following remedies should be considered in correcting conditions causing emulsions in oil-well pumps which are in good condition.

1. Decrease pumping speed.
2. Use of a gas anchor.[3, 4]
3. Decrease plunger spacing.
4. Maintain pump submergence.

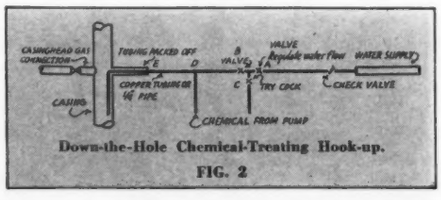
Operators report that they have secured beneficial results by observing these precautions.

One instance was reported in which re-spacing the pump reduced the cost of chemical dehydration about 50 per cent.

It is believed that pumping wells which are producing excessive quantities of emulsions should be investigated for the above possible causes of emulsions.

A preliminary test to determine the ease of emulsifying the oil will be of benefit. If the oil is easy to emulsify, all of these items should be considered.

The greatest source of emulsions is experienced from worn pumps. Dehydrating costs increase if worn pumps are used, because the emulsion con-



Down-the-Hole Chemical-Treating Hook-up.
FIG. 2

tent increases so greatly. For example, on one lease of 20 wells, 2 badly worn pumps increased the electric-dehydrator cuts from 1.5 to 4.0 per cent, requiring the use of chemical to keep the cuts below 3 per cent (pipe-line requirements). On another lease chemical dehydration was used entirely, treating 18 wells. There were times when, because of worn pumps, the chemical consumption had to be increased 100 per cent.

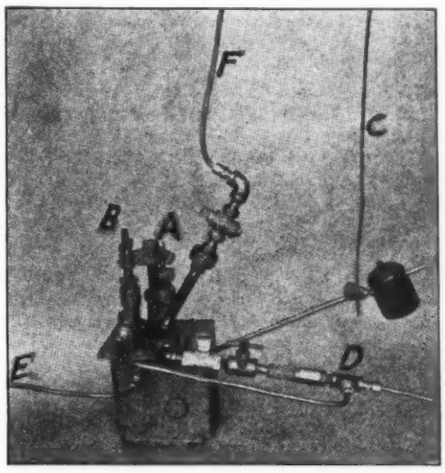
In fields in which the production is practically free of sand, pumps wear very slowly, and the emulsion content of the pumped oil increases slowly with the age of the pump.

The examples shown in Table 1 will serve to prove this point.

TABLE 1—INCREASE IN EMULSION WITH INCREASE IN AGE OF PUMP

Well No.	Length of time pump was in service (Months)	Per cent water and emulsion: Total	Water	Emulsion
1	3	5.0	4.5	0.5
	18	6.0	4.0	2.0
2	22	5.0	2.5	2.5
	34	11.0	1.0	10.0
3	1	10.0	4.0	6.0
	12	12.0	2.5	9.5
4	4	7.0	3.0	4.0
	15	22.0	13.0	9.0
5	1	28.0	4.0	24.0
	12	44.0	0.00	44.0
6	14	13.0	10.0	3.0
	27	35.0	3.0	32.0

Some oils cause excessive pump wear, usually because of sand—resulting in the necessity of pulling pumps every month or oftener.



Combined chemical and water pump.
Figure 3

As long as the dehydrating costs do not increase appreciably and the production rate holds up, there is no need to pull the pump, even though it is creating a great deal of emulsion. An economic balance should be maintained between the cost of pulling pumps and the dehydrating cost. The lifting cost of oil can be increased to more than offset the saving in dehydrating cost if one becomes overzealous in preventing emulsions. Usually it is not economical to pull well pumps until the production rate decreases appreciably due to wear.

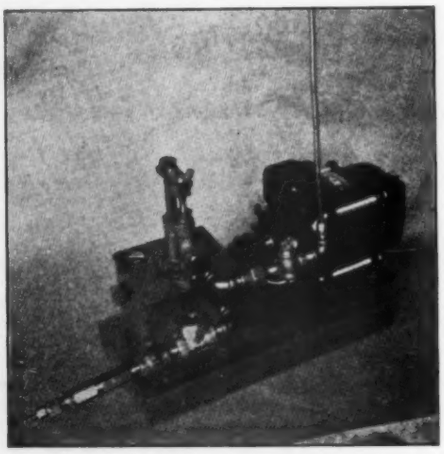
Some oils are difficult to emulsify, and the oil can be dehydrated by settling the water. The well pumps in these instances do not cause more than 1 to 3 per cent of emulsion, most of which is unstable, and will resolve into oil and water if allowed to stand for one or more days. Some oils require heat to settle the water, the emulsion being just a little tighter, or the difference in specific gravity between the oil and water being very small. There are many leases in California producing oil, which is dehydrated by settling alone. Many others require heat. Some oils require constant pump vigilance to be treated successfully by settling methods.

The injection of chemical down the casing of a pumping well will often prevent the formation of permanent emulsions in the pump. In many in-

[a]Figures refer to bibliography.

stances it is cheaper to treat the oil in this manner than to inject the chemical into the oil at the well head or in the lead line. When casing injection fails, it is because re-emulsification takes place due to excessive agitation in the tubing or lead line, or the chemical does not reach the bottom of the well. Sufficient chemical should, of course, be used to dehydrate the oil satisfactorily.

The cost of "down-the-hole" treatment will usually vary from one to five mills per barrel of net oil. The chemical is usually injected by means



Motor-driven injection pump.

Figure 4

of a simple reciprocating pump operated by the beam of the well. Fig. 1 shows such a pump. The chemical container is not shown. Pipe A is the suction line. It was raised to a vertical position while taking the picture, but is ordinarily in a horizontal position.

The chemical should be introduced into the casing commingled with water or oil, so that it will be carried down to the fluid in the well. The modern trend is to use water as a carrying agent, regardless of whether the chemical is water soluble or not. One to five barrels of water are usually used per day, depending on the size of the well. If the water supply has a pressure in excess of the casing pressure, the water can be directly connected to the casing from the water main, using one-fourth inch pipe or copper tubing, and regulating the flow with a valve. Fig. 2 is a diagrammatic sketch of such an installation. The water supply line, with check valve to prevent a reversal of flow if the casing pressure should become greater than the water pressure, is shown at the right. Valve A regulates the rate of flow of the water. The rate of flow can be checked approximately by closing valve B and opening trycock C. Chemical from the chemical pump enters the water line at D. The line is packed off in the casinghead connection E. Often about 3 feet of flexible tubing is inserted into the casing as shown, although the line can usually be terminated at the casinghead connection if the gas outlet is on the oposite side of the casing. The water is pumped down the casing if the water main pressure is too low. In Fig. 3 a single operating mechanism is used to operate a one-fourth inch or three-eighth inch chemical pump A and a three-fourth inch water pump B. Throttle cord C is used to operate the pumps from the beam. The water is injected into the chemical pump discharge at D. The water-pump and chemical-pump suction lines are represented by E and F, respectively. The cost of this chemical-pump and water-pump installation is about $40. The cost of the chemical pump alone with all fittings is about $30.

Tests must be conducted for each lease, and on representative individual wells, to determine whether "down-the-hole" treatment is justified. Electric dehydration may be cheaper, or treatment further along the oil-gathering system may be more economical.

Tubing Turbulence

Leaky Tubing—Tubing leaks, consisting of splits or leaky collars, produce very tight emulsions in pumping wells, and are often difficult to find if near the top of the string of tubing. Old strings of tubing cause a great deal of dehydration trouble because of leaks. The remedy is obvious.

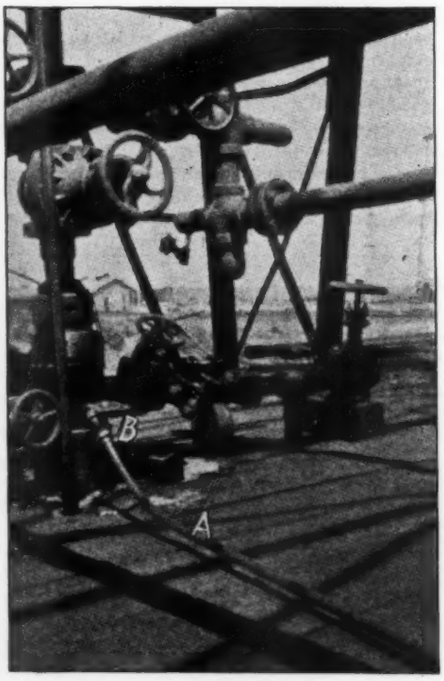
In one instance, the oil from a pumping well was being dehydrated by passing it through an excelsior-packed column and a settling tank. The cuts from the well suddenly showed 5 per cent of very tight emulsion which, of course, made it necessary to use chemical to dehydrate the oil. The production of the well had not decreased sufficiently to be noticed. The pump was pulled, but no wear was discovered. The trouble still persisted, and the tubing was then pulled. Two very small leaks were found near the top of the tubing.

Slippage and Gas Agitation

In flowing wells, and especially gas-lift wells, slippage of the rising column of fluid will, of course, produce emulsions. The oil and water in the tubing of flowing and gas-lift wells is often completely emulsified, with no free water present, according to samples taken in bombs (see B, Fig. 7) from a connection on the upstream side of the flow bean. On the other hand, flowing wells and gas-lift wells, producing at uniform rates without much turbulence, produce a great percentage of free water which can be settled out. It is believed that the correct size of tubing will obviate some slippage. Optimum gas-oil ratios will probably also help. However, no data of a practical nature are available to substantiate these statements.

From the known effect of gas in lead lines, it is believed that emulsions are formed in pumping-well tubing strings when the gas-oil ratio is high and the oil is easy to emulsify. The use of gas anchors should be of some benefit, as would high fluid levels and optimum casinghead pressures. These are merely suggestions which appear to be logical. No actual data have been secured to prove their effectiveness.

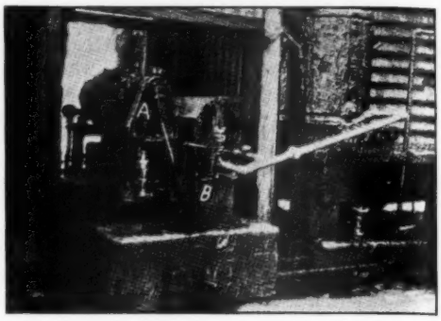
Chemicals are sometimes injected into the casing to prevent permanent emulsions in the tubing. In flowing and gas-lift wells, the cost of chemical treatment will vary from 3 mills to 1 cent per barrel of net oil. The casing pressures on these wells are so high that the pumps used for injecting must be well constructed. Motor-driven chemical pumps



Connections for injecting chemical into the casinghead of a gas-lift well.

Figure 6

using ¼-in. to ½-in. plungers cost from $75 to $110 (see Fig. 4). The chemical pump can be discharged directly into the suction of the triplex pump if the casing pressure is too high. From 5 to 20 bbl. of water are pumped into flowing and gas-lift wells per day. Water is usually used as a carrying agent, although oil can be used. Oil is much more troublesome, and water often gives better results. Carrying-agent pumps are usually triplex pumps, and cost from $250 to $750. In Fig. 5 can be seen a triplex pump, A, used for pumping water (carrying agent), and B, a chemical pump, mechanically connected to pump A, discharging into the suction line of pump A. Fig. 6 shows a ½-in. chemical in-



Triplex pump used for pumping water as a carrying agent for chemical.

Figure 5

jection line, A, connecting to the casinghead, B, of a gas-lift well.

In one case, the amount of chemical required to treat several gas-lift wells down the hole was reduced 35 per cent by using water for a carrying agent instead of oil. The chemical was a so-called oil-hole (miscible) compound.

In one instance, a gas-lift well, producing 3,500 bbl. of 25-deg.-API oil cutting 80 per cent, emulsified the oil and water so badly that the viscosity became excessive. This resulted in dangerously high injecting pressures, heading, and difficulty in starting flow. The injection of chemical "down the hole" eliminated this difficulty. However, it is believed that excessive viscosities due to emulsion can be obviated by maintaining optimum gas-oil ratios. Entirely too much gas is often used to lift the production. When such a condition is encountered, it is suggested that an effort be made to reduce the quantity of gas used.

The turbulence is so great in the tubing of flowing and gas-lift wells that it is usually more economical to inject at least a major portion of the chemical behind the flow bean. Re-emulsification apparently takes place in the tubing. In three actual cases observed, 25 to 35 per cent more chemical was required when it was all injected down the casing instead of all being injected behind the bean.

In pumping wells "down-the-hole" treatment is more likely to be economical, because less turbulence takes place in the tubing. The same data would apply as was given under the oil-well pump discussion.

Flow Beans

Flow beans used in flowing and gas-lift wells will cause emulsions if the oil and water have not been completely emulsified before reaching the bean, and if high velocities exist. The greater the pressure drop across the bean, the tighter the emulsion will become. Samples taken of oil on the upstream side of the bean and compared with samples from the downstream side, show that, if the flow is steady and not violent, with very low pressure drops, emulsions are not necessarily produced even though as high as 4,000 bbls. of fluid are produced per day. One gas-lift well, producing about 600 bbl. of oil and 3,500 bbl. of water very uniformly, with a casing pressure of 500 lb. and a tubing pressure of 90 lb., flowing through 2¾-in. beans, produces about 3,000 bbl. of free water. The flow beans do not cause any additional emulsion

because of the absence of agitation. Injection of chemical behind the beans of this well is more economical than "down-the-hole" treatment.

Preventive Methods—Chemical is often injected on the upstream side of flow beans for the purpose of preventing emulsions. This point of injection is nearly always the most economical place to inject chemical. In Fig. 7 such a connection is shown at A. The bomb, B, is used to secure oil samples without additional emulsion.

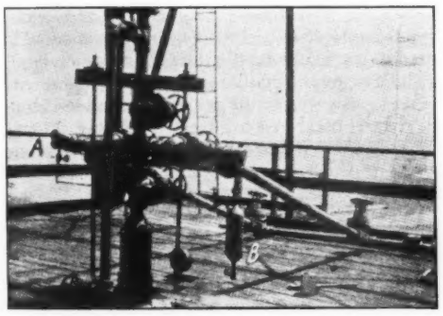
Pumping Water Behind Flow Beans or Into Well—It has been suggested at various times that the pumping of oil-field water behind the bean or down the well[5] might be a remedy for emulsion formation. It has been found (particularly in the manufacture of commercial emulsions) that there is an optimum oil-water ratio (20-30 per cent water) which will produce the most stable emulsion. A higher percentage of water than the optimum percentage will not produce all emulsion, and the emulsion will not be as tight.

In experiments performed on sump oils and drilling oils which are easy to emulsify, it was found that the passing of oil-field water and the oil through a pump valve as an orifice which produced pressure drops of only a few pounds produced all emulsion and one which could not be dehydrated. From 20-50 per cent of water was used.

There are cases on record of gas-lift wells producing as much as 600-800 bbl. of oil and 2,500-3,500 bbl. of water, in which no free water remained on the upstream side of the bean because of excessive agitation in the well.

From these data it would seem that, in some instances, additional emulsions would be produced if water were injected behind the bean. However, this would not necessarily hold true in general.

The cost of pumping the water against a tubing pressure of 100 lb., or more, and the cost of making the oil-field water available at each well would amount to 1 mill or more per barrel of water handled.



Injection connections showing sampling bomb.
Figure 7

No operating data are on hand to be of any assistance in this discussion. However, it is believed that this method is not of sufficient value to be considered.

Water Traps (Squeeze Traps)—Water traps[6] have been used frequently for separating water from oil, before the free water has become emulsified by its passage through flow beans or transfer pumps. The water trap is placed on the high-pressure side of the bean. Water traps are frequently made out of casing, and are necessarily of small capacity because of cost. Tanks capable of withstanding the pressure may be used instead of casing. The cost of water traps will usually be about $500, depending on size. Such a trap is incapable of settling out any water unless the water is absolutely free. A great deal of supervision is required to keep the water drained out. It may be possible to use successfully an electrically controlled valve as an automatic water bleeder. This would obviate one serious disadvantage of these traps. Fig. 8 is a diagrammatic sketch of a squeeze trap. The oil inlet is at A, and the oil leaves the trap at B through a flow bean. The free water settles out of the oil, and is bled off at valve C. Pipe D will vary in length from 20 ft. to 150 ft. It may slope, as shown in the sketch, or may be horizontal. E may be horizontal, or may slope toward the water outlet C. The water legs, F, convey the water from D to E, and are usually made of smaller size pipe.

Tests show that even many pumping wells do not produce sufficient free settling water to make such a method practical. Flowing and gas-lift wells often do not produce any free water in the top portion of the tubing.

Water traps are, therefore, limited to wells producing large quantities of free water, which will settle out immediately. The cost of a water-gathering system to the wells must be considered in any investigation for determining the advisability of using water traps. Also, in some instances, the oil will have to be dehydrated, even though water traps are used, because not all of the water can be separated; so the saving in dehydrating cost should be determined before installing such a system.

In one instance chemical was being injected on the upstream side of the flow bean of a flowing well for the purpose of dehydrating the oil. It was found that the installation of a water trap permitted a large decrease in chemical required to treat oil. The chemical broke down the emulsion while the oil was in the trap, and permitted the water to be settled out.

Lead-Line Turbulence

Emulsions are often formed in the lead lines extending from the well to the oil tanks. The following causes and remedies will be considered:

Restrictions in Lead Lines: Wax accumulations will sometimes build up to the point where the opening in the lead line is reduced to ¼ in. or less, causing excessive pressures and resulting in leaks in tubing and pumps, and causing emulsions. Of course, only certain wells are subject to wax troubles.

The remedy for wax deposition is to put a pressure gage on the lead line at the well, and observe the increase in pressure. When the wax deposit begins to cause an increase in pressure, the wax should be removed. The circulation of hot water has been used successfully, treating 500 ft. or less of pipe at one time. Frequently solvents are used, usually with heat. Occasionally heaters are used to keep the production heated sufficiently to obviate wax deposition in the lead lines. Wax trouble occurs during cold weather only. Sometimes fires are placed under the lead line, at intervals of 100 ft. or so, to melt out the wax or to prevent its deposition.

It has been reported that the continued injection of dehydrating chemical in the lead line at the well will obviate the accumulation of wax.

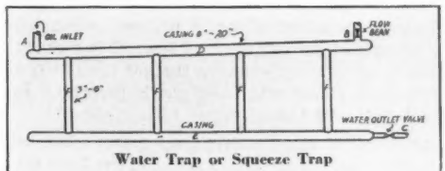
Excessive Bends and Fittings: This condition is not found very often, so little consideration need be given to this subject. Restricting fittings such as globe valves or regulating valves will create emulsions, and should be eliminated if possible. On one lease the elimination of excessive bends and restrictions aided in solving the dehydrating problem. Other changes were made, however, which produced greater benefits; so little credit can be given to their elimination.

Gas in Lead Lines: In many oil fields the casinghead gas is connected into the lead line for the chief purpose of saving the expense of constructing a separate gas line, although some operators prefer to liven the oil with gas, hoping to prevent wax accumulation in the lead line and to increase the gravity of the oil.

Many tests have proved that the casinghead gas is often responsible for the formation of additional emulsions. However, some wells produce oil which is difficult to emulsify; and, if the rate of flow through the lead line is low and agitation is kept to a minimum, very little additional emulsion is produced.

Examples of the effect of casinghead gas in the lead line are tabulated in Table 2.

The first seven wells are in the same field and show that, in general, emulsions are formed in the lead line by the presence of casinghead gas. All wells in this field show either an increase in emulsion or a tightness of emulsion, although it is slight in some cases. About 25 per cent of the dirty wells can be dehydrated by settling methods, using an excelsior-filled tank or column, without the use of chemical, if the casinghead gas is taken out of the lead line. The other wet wells require chemical or electric dehydration, even though the gas is separated. However, tests have proved that less chemical is required if the gas is removed from the lead line, although in some wells in this field the economy effected would hardly justify the expense of providing a gas line.



Water Trap or Squeeze Trap
FIG. 8

Apparently, if the oil and water are nearly all emulsified at the well, the casinghead gas does little harm. The increase in quality and quantity of emulsion was greater in the production containing the least emulsion at the well.

The gas-oil ratio does not seem to be the controlling factor in emulsion formation.

The last five wells are in a different field, and show that, in general, no appreciable increase in emulsion occurred even though the gas-oil ratio is high. There is only one well (No. 11) in the whole field which shows any great increase in emulsion content. The oil in this field is dehydrated by heating and settling. Even though the gas were separated from the lead line, tests show that heating would still be necessary; hence no advantage can be gained by taking out the gas.

These examples are given to show that oils from the same fields react in different manners. Each well represents an individual problem, and tests are required to determine what effect casinghead gas produces in the lead line.

In one large field, oil from several leases and different zones, with a gravity of around 30 deg. API, had been dehydrated by electricity or chemical means for many years. By reducing the casinghead pressure and separating the gas from the lead lines, all of the oil is now being dehydrated by settling—no heat being required—at a saving of approximately 1¼ cents per barrel of oil treated.

TABLE 2—EFFECT OF CASINGHEAD GAS ON FORMING EMULSION IN LEAD LINE

	Cut at Well			Cut at Gage Tank				
Well	Total (Barrels)	Water (Barrels)	Emulsion (Barrels)	Total (Barrels)	Water (Barrels)	Emulsion (Barrels)	Oil (Barrels)	Gas (1,000 Cu. Ft.)
1 [a, d]	42	35	7	50	7	43	200	50
2 [a, d]	30	26	4	34	7	27	200	50
3 [a, c]	8	8	0	9	0 5	8 5	180	120
4 [a, d]	25	4	21	25	4	21	280	50
5 [a, d]	38	16	22	38	16	22	300	90
6 [a, d]	11	7	4	12	0 05	11 5	325	40
7 [a, d]	50	16	34	50	32	18	200	50
8 [b, e]	17	13	4	17	13	4	38	26
9 [b, e]	28	27	1	28	26 5	1 5	36	9
10 [b, e]	36	30	6	36	32	4	35	1
11 [b]	12	10	2	14 5	2 5	12	40	30
12 [b, e]	26	25	1	26	24	2	130	10

[a] 28-deg.-API oil.
[b] 19-deg.-API oil.
[c] Emulsion very tight at gage tank.
[d] Emulsion slightly tighter than for well No. 3.
[e] Very little change in emulsion.

In another field the separation of the casinghead gas from the lead line, and eliminating repumping of the oil, resulted in the oil being dehydrated by settling means alone—resulting in a saving of about 1½ cents per barrel of oil treated. Both of these fields produce oil which is easily dehydrated; otherwise it would not have been possible to eliminate such a large part of the dehydrating cost.

There are a great number of leases in which the casinghead gas is not separated, and the oil can be dehydrated by settling alone; hence no hard and fast rule can be given regarding the separation of casinghead gas. Tests alone will determine what effect the casinghead gas has in the lead line. Each well may represent an individual problem. Fig. 9 represents a typical casinghead-gas lead-line connection. A is the lead line; B, the wet-gas line conveying the gas away from the well; C, the gas-pressure regulating valve; D is closed when the gas is separated from the lead line; E is a check valve to prevent oil entering the gas line; F is a valve to be closed when the gas is permitted to flow into the lead line.

The cost of electric dehydration can often be reduced by separating the casinghead gas from the lead line. It is frequently possible to eliminate the heating of the oil—resulting not only in a saving of 3 to 6 mills for heating, but also additional economies in gravity conservation and power consumption.

The amount of saving will, of course, depend on the quantity of emulsion being formed by the gas. In one case, two wells are being treated by injecting chemical into the beginning of the lead line of the larger well. The production from the other well is discharged into a gas trap with the first well, and the production from both wells then flows into a series of two settling tanks, The separation of the casinghead gas did not reduce the emulsion content appreciably; however, the cut of the first settling-tank overflow was reduced as follows, using the same quantity of chemicals:

	Per Cent Water and Emulsion		
	Total	Water	Emulsion
Casinghead gas in flow line..	5 4	4 4	1 0
Casinghead gas separated ...	4 0	3 8	0 2

In this particular case, it can be seen that the separation of the casinghead gas from the lead lines would be unprofitable. The expected economy can be predicted by taking cuts at the beginning and end of each flow line.

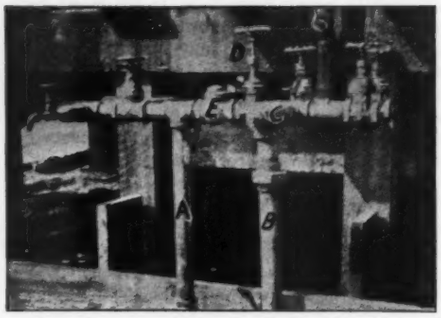
If the cost of laying a gas line to a well were $600 and the well will produce an average of 200 bbl. of oil per day for the period under consideration, and if the chemical cost per barrel of oil was ½ cent and the contemplated change would reduce the cost of chemical to ¼ cent, the expenditure would be justified, because it would be paid back in less than four years.

Gaging Methods

The oil-gaging method in use affects the formation of emulsions. If gage tanks are used and the oil cannot be gravitated out of the gage tanks to the dehydrating plant, the oil must be pumped—which produces additional emulsion. Data secured in many pumping fields show that this method of gaging is responsible for a large percentage of the emulsion found in the oil, and that the cost of treating a barrel of gaged oil is often increased from 5 mills to 1 per cent or more. This is such a common occurrence, and so indisputable, that space will not be given to produce substantiating data. Also the following section, which deals with "transfer pumps," presents data which will cover the effect of pumping oil, regardless of the purpose.

If wells are gaged for eight hours once a week, only 1/21 of the oil would be so handled; and, if it were possible to have the well convey the oil to the dehydrating plant at all times when not in gage, the effect will not be nearly so severe as when all of the production is re-pumped.

Gravitation of the oil from the gage tanks does not cause emulsion if the velocity is not too great



Typical casinghead-gas lead-line connection.

Figure 9

In one field it was found that the average emulsion content of the oil from about 50 wells decreased 50 per cent during the travel of the oil through the gravity line. The emulsion was what would be classed as relatively loose. Oil from a different zone in this same field showed no appreciable change. The gravity of the latter oil was 19 deg. API.

When pumping of gaged oil is required, the injection of chemical into the pump suction will aid in preventing emulsions. Less chemical will be required than if it were introduced into the pump discharge. Field tests made on many pumps, and on large quantities of oil, show that as much as 50 per cent more chemical may be required when injected into the discharge line of the pump. It was found that the condition of the pump, as well as the type of pump, made a difference—excessive agitation always causing additional emulsion. Of course, when dehydration is accomplished electrically, chemical is rarely required.

The chemical pump should be mechanically-connected to the oil pump if possible; otherwise an electric-driven chemical pump should be connected to the electric switch of the oil pump, thereby obviating the possibility of oil being pumped without the chemical pump being operated.

The cost of chemical treatment in this manner will cost from 1 mill to 1 cent per barrel of oil—the average being about ½ cent.

Sometimes the water can be settled out without heat after being treated in the above manner.

The use of a suitable oil meter which can be made a part of the lead-line system will obviate the necessity of pumping out gage tanks and will, of course, aid in eliminating the formation of additional emulsion in the oil. If the gaging equipment contains a pressure-regulating valve, controlling the oil flow, some emulsion may be formed when the oil passes through the valve; so the pressure drop should be maintained as low as possible.

No data are at hand to show how much has been saved in any particular instance from eliminating the pumping of gaged oil by using oil meters.

Transfer Pumps

It is intended that this heading should include all pumping or gathering of undehydrated oil after it has been brought to the surface of the ground, except gaged oil.

Tail pumps were commonly used for transferring wet oil in the past, and are still used to a lesser extent. In this service they operate a great deal of the time with only partly-filled barrels, because they are operated continuously and are consequently able to keep the receiving tanks pumped down to the suction-line level. This results in a great deal of emulsion being produced when the oil is wet. A practical remedy is to disconnect the tail pump as soon as the tank is emptied.

Modern practice consists of using electric-driven reciprocating pumps which are operated only when there is oil to be pumped. The control is either manual or by float control.

Even though these improvements are adopted, a great deal of emulsion is formed when transferring oil with pumps.

If the terrain permits, the establishment of a gravity gathering system will usually obviate the formation of a great proportion of the emulsion which would otherwise be present due to transferring with pumps.

There are a great number of leases in California on which the oil is gathered by gravity lines, thereby permitting the dehydration of the oil by settling alone. Of course, the separation of casinghead gas from the lead lines is often required to permit dehydration by settling—although not always, as was pointed out previously in this paper.

On some leases on which the oil is now gathered by pumps, tests have proved that if the oil could be dehydrated before being transferred, the cost of dehydration could be reduced from 20 to 80 per cent.

Of course, the oil and water will both have to be pumped unless they can be gravitated, but the saving in dehydration cost will usually more than justify the additional investment for a waste-water line and pumps. Some operators provide both a clean and a wet-oil line gathering system in the development of their leases—which, of course, will permit the wet-oil line to be used for waste water.

The following example will show what can be often accomplished by dehydrating the oil before it is pumped from a gathering point to the dehydrating plant.

The cost of treating the oil chemically at the central location, using a hay tank, and heat was 1¼ cents per barrel of oil. The same production is now being treated at the several gathering points at a total cost of 4 mills. No heat is required. The cost of the additional equipment required in this instance can be paid for in less than one year.

Additional reasons for treating the oil as soon as possible is that the deeper wells produce warm oil, and the well temperature can be thus conserved and used; also, emulsions become stabilized with age, especially during the first 24 hours.

The cost of the additional equipment required at these gathering points will vary considerably; but, if 1,000 bbl. of oil are treated per day, an expenditure of from $1,000 to $3,000 will be required usually, depending on the equipment required and the method of dehydrating adopted.

The prevention of emulsions can be accomplished by:

1. Reducing the degree of agitation.
2. Producing physicochemical conditions unsuitable for emulsion formation.
3. Separating the water before agitation takes place.

All three methods are used, but the first is the most important.

The origin of oil-field emulsions can be ascribed to turbulence in the following places:

1. Well pumps.
2. Tubing.
3. Flow lines.
4. Transfer pumps.

Prevention in the last two groups has made the greatest amount of progress because of more opportunity to make large savings. However, the first two groups should be investigated, if any dehydration trouble is encountered or if the dehydrating costs are high.

Some operators have secured greater dehydration economies by eliminating emulsions than by improving dehydration methods and equipment during the last year or two. For this reason, further investigation of this subject should prove of economic value.

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[4] H. C. George, *Oil-Well Composition and Operation*, 185-8, University of Oklahoma Press (1931).

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Oil-Well Performance:

Discussion and Proposed Terminology

By B. P. KANTZER and E. G. TROSTEL
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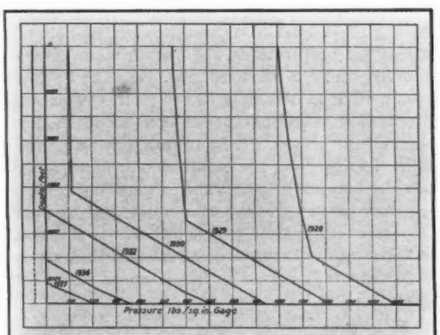
Inasmuch as an apparent need has been felt for definitions and limitations concerning well-performance measurements and interpretations, it is herein proposed to discuss in some detail those terms most commonly encountered in current production practice. By well performance is meant those sub-surface characteristics of a well which are divorced from any consideration of the method by which the oil is brought to the surface.

Henry Darcy, in 1856, published the first extensive study of water flow through sands. Since that time many studies of water-well performance have been published, among them a detailed treatment of terminology by O. E. Meinzer.[1a] Extensive oil-well performance measurements date back to the advent of the sub-surface pressure gage. In 1930 T. V. Moore[2] discussed the use of sub-surface pressures in relation to well performance. Since that time many investigators have published papers concerning well performance, but to date no consistent nomenclature has been established.

In order to define terms which are rather loosely used in production technology, an effort



Typical Static-Pressure Traverses During Life of Well.
FIG. 1

has been made to combine the salient features of published and oral opinions with fundamental concepts. Future requirements in terminology will no doubt necessitate additional nomenclature. In an attempt to anticipate such future needs, a discussion of some terms not commonly used is included. Due to the variety and complexity of the many factors involved in well performance, complete analysis is impossible, and simplifications are required. Most of the terms to be discussed herein are variable with time. However, this discussion will not be concerned with such time functions.

It is hoped that the proposed terminology will foster a more general "meeting of the minds"; and, to make the terminology as universal as possible, criticism and discussion of this paper are particularly invited.

Well-Performance Measurements

For the purposes of clarifying terms as they occur, a brief review of common sub-surface pressure-measurement procedures will be given. In general, it might not be amiss to point out the necessity for accuracy and dependability of all measurements.[3]

Static Measurements

Perhaps the most common of sub-surface pressure measurements are those in wells which have been shut in. A recording pressure gage is lowered into the well, and pressures are measured at various depths in the well.[4, 5] Fig. 1 illustrates various types of curves which can be drawn to show the depth-pressure relationships in the well. Obviously, a static pressure, as such, has no meaning unless referred to a specified depth or datum. The term "bottom-hole pressure" has been loosely applied at times to designate pressures existing at indefinite depths other than the bottom of the hole. For this reason it is strongly recommended that the use of the term be discontinued unless the datum is the bottom of the hole.

A.P.I. — Paper presented at annual meeting, Chicago, 1937.

When a well is shut in, the reservoir pressure in the immediate vicinity of the well bore rises to approach the existing reservoir pressure. Depending upon the flow characteristics of the producing zone, the well pressure will approach equilibrium conditions at various rates. To study this phenomenon, measurements are made of pressures existing at a given datum at various stages of the pressure increase. Fig. 2 illustrates the behavior of various wells during this build-up period.

Sub-surface shut-in pressures at other than equilibrium conditions should be qualified for depth and length of shut-in time. *It is, therefore, proposed to define shut-in non-equilibrium pressure as:*

$$P_{d,t} = \text{non-equilibrium shut-in pressure} \quad (1)$$

where: P = pressure, lb. per sq. in., gage.
d = datum in feet of depth below the derrick floor.*
t = shut-in time, hours.*

* Datum in feet of depth sub-sea, and shut-in time in days, may be substituted if properly noted.

In view of the above considerations, a static pressure should be qualified for depth, and should represent equilibrium conditions. *It is, therefore, proposed to define static pressure as:*

$$P_d = \text{equilibrium shut-in pressure} \quad (2)$$

where: P = pressure, lb. per sq. in., gage.
d = datum in feet of depth.

For example, a static pressure of 1,000 lb. per sq. in. in a well at a depth of 6,000 ft. will be denoted as: $P_{d=6000} = 1{,}000$ lb. per sq. in.

Temperature measurements should be treated in a similar manner. Sub-surface temperature shall be defined as:

$$T_d = \text{sub-surface temperature} \quad (3)$$

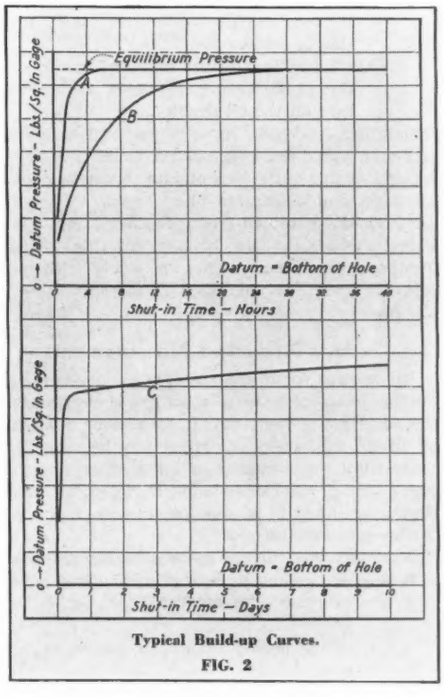
where: T = temperature, deg. F.
d = datum in feet of depth.

Producing Sub-Surface Pressure Measurements

1. Flowing and Gas-Lift Wells

Every precaution should be taken to insure equilibrium conditions during the measurement of a producing sub-surface pressure. Pressures measured shortly after a well is put on production or after a change in production rate will often be misleading, inasmuch as they represent transient states. Often the passage of the gage through the tubing disturbs equilibrium; consequently, the gage should be left *below* the tubing for a sufficient length of time to check the producing rate at that time with the equilibrium rate.

A producing sub-surface pressure should be



Typical Build-up Curves.
FIG. 2

modified as to datum and production rate. *It is, therefore, proposed to define a producing pressure as:*

$$p_d,R = \text{producing pressure} \quad (4)$$

where: p = pressure, lb. per sq. in., gage.
d = datum in feet of depth.
R = production rate in *gross* barrels per day (see Fig. 3).

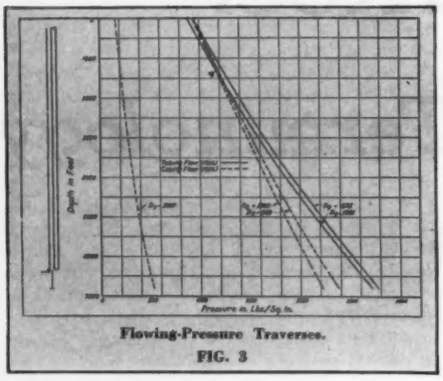
For example, a producing pressure of 750 lb. per sq. in., gage, in a well at a depth of 6,000 ft. while producing 500 gross barrels per day will be denoted as $p_{d=6000,(500)} = 750$ lb. sq. in.

2. Pumping Wells

The mechanics of using a recording sub-surface

[a] Figures refer to bibliography.

pressure gage in a pumping well depends on the installation in a particular well. Simple means usually can be employed to run the gage integrally with the pump without pulling tubing. In some cases the gage goes through the shoe into the gas anchor, and in other cases it is used in a "sub"



Flowing-Pressure Traverses.
FIG. 3

between the shoe and the pump. Where an insert pump is not used, a section at the bottom of the gas anchor may be used to accommodate the gage. Fig. 4 illustrates various methods.

As in the case of flowing wells, care must be taken to insure equilibrium conditions lest transient pressure-rate conditions be recorded.

Usually, the datum with which one is concerned is the gage position at the pump. Should pressures at another datum, or average pressures, be desired, a pressure translation can be made by estimating the fluid density. Factors entering into such an estimation will be:

a. Oil gravity.
b. Cut and salinity of water.
c. Average temperature and pressure prevailing over the interval in which the translation is made.
d. Gas-oil ratio, and the effect of gas in solution at the average pressure and temperature on the oil density.

When appreciable amounts of gas, water, or both gas and water are present, such estimations are hazardous due to the lack of data concerning foam, slippage, and dispersion phenomena. Curves experimentally obtained from producing depth-pressure traverses can also be used for this purpose. Temperature measurements are made with maximum-registry thermometers run integrally with the pressure gage.

Surface Production Measurements

In setting forth the sub-surface pressure-production characteristics of a well, it is obvious that the accuracy of the result is no greater than that of either measurement. Much has been written concerning the accuracy of sub-surface pressure gages, and precautions should be taken to insure similar accuracy in production measurements and surface-pressure records.

Fundamental surface measurements are those of tubing and casing pressures, symbolized as:

P_{tbg} = tubing-head pressure, lb. per sq. in., gage ..... (5)

P_{csg} = casing head pressure, lb. per sq. in., gage ..... (6)

In symbolizing production measurements and terms, the following conventions are proposed:

Liquid rates (at standard conditions of 60 deg. F.):

R_g = gross rate, barrels per day (oil and water) ..... (7)

R_o = net rate, barrels per day (oil) .... (8)

Gas rates (at standard conditions of 60 deg. F. and 30 in. of mercury):

Q_g = gross M.C.F.† per day ..... (9)

Q_c = circulated M.C.F. per day ..... (10)

Q_f = formation (net) M.C.F. per day .. (11)

†Thousand cubic feet.

Much confusion can arise from the improper or careless use of the term "gas-oil ratio." The following terms are proposed to clarify the uses:

Q_f/R_o = formation gas-oil ratio ..... (12)

Q_f/R_g = formation gas-liquid ratio .... (13)

Q_c/R_o = circulated gas-oil ratio ..... (14)

Q_c/R_g = circulated gas-liquid ratio .... (15)

Q_g/R_o = gross gas-oil ratio ..... (16)

Q_g/R_g = gross gas-liquid ratio ..... (17)

In pumping installations the total gas production is from both the tubing and the casing. When separate gas measurements are made, the following terms are useful:

Q_{tbg}/R_g = tubing gas-liquid ratio ..... (18)

Q_{tbg}/R_o = tubing gas-oil ratio ..... (19)

Terminology of Well-Performance Calculations

Mean Pressure Considerations

For purposes of comparing pressures measured at several production rates in a single well, or for comparing two or more wells, a common basis must be used in expressing pressures. With ideal sand conditions, such as uniformity in productivity and stratigraphy, and with the entire zone open to production, a fundamental basis for expressing sub-surface pressures would be that of calculating a mean pressure.

A mean pressure is defined as that pressure obtained by measuring the area bounded by the pressure-depth curve, the depth axis, and the two lines corresponding to the top and bottom of the formation open to the well, and dividing by the length of the perforated interval ..... (20)

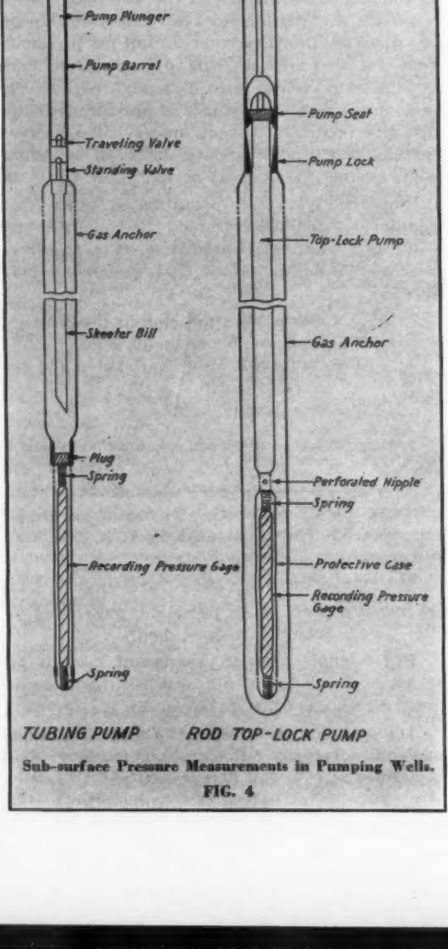
(See Fig. 5.)

Then:

$\overline{P}$ = mean static pressure, lb. per sq. in.. (21)

$\overline{p}$ = mean producing pressure, lb. sq. in (22)

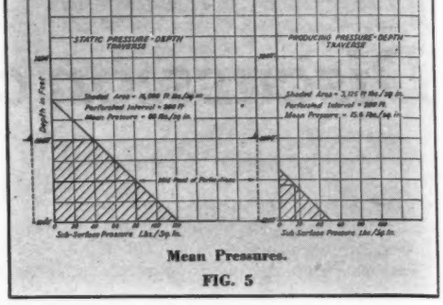
When the static fluid level in a pumping well lies below the top of the perforations, it is necessary to consider the fluid level as the effective top of the perforations.



Sub-surface Pressure Measurements in Pumping Wells.
FIG. 4

In many cases the calculation of a mean pressure from measured data necessitates estimation of flowing gradients, with the consequent hazard of introducing error. Such estimations are necessary when:

a. Pressure measurements cannot be made outside the tubing.



Mean Pressures.
FIG. 5

b. Static and producing pressures have been measured at only one depth, as in a pumping test.

Other factors which influence the selection of a method of expressing sub-surface pressures are:

a. Unequal permeability and productivity of various portions of a producing zone.
b. Lack of complete penetration in wells producing from a homogeneous body.
c. Values of mean static pressure or datum static pressure other than at the bottom of the hole may depend in part on the manner of shutting in a well, etc.
d. Conditions where producing fluid levels are above the top of the perforations lend themselves to the use of either datum or mean pressures.

Due to reasons such as those outlined above, many engineers resort to the use of a datum pressure, commonly taken at the bottom of the hole or mid-point of the perforations.[6, 7] Such procedure is simple and usually justifiable. When the producing fluid level in a pumping well is below the top of the perforations, the use of mean pressures should yield the most reliable results. In special instances it is desirable to set forth the pressure-production relationship existing at other depths such as the bottom of the tubing, or at a pump intake. In any case, the conditions at hand will dictate the manner in which the measured sub-surface pressures are expressed. Obviously, precise evaluation of average flow characteristics is impossible in a composite horizon of sands and shales where each sand may act as an independent reservoir.

Build-up Curves

Measurements of static sub-surface pressures are intended to represent equilibrium conditions between the well bore and the reservoir.

The plot of datum or mean shut-in pressure vs. time is defined as a build-up curve. (23)

(See Fig. 2.) The rate at which the pressure builds up in a well is a widely variant function, and in a large number of cases static equilibrium pressure is not attained in a reasonable shut-in period, as determined by inspection of the build-up curve. In all cases discretion should be used in determining how closely the equilibrium pressure should be approached in measurement or estimation. Morris Muskat[8] has commented upon the calculation of equilibrium pressures from incomplete data. Build-up curves are valuable in intermittent flow calculations. A study of build-up characteristics over short time intervals furnishes necessary information as to pressure-time relations for ascertaining proper lifting conditions.

Draw-down Curves

A study of the producing characteristics of a well is facilitated by the construction of a curve showing sub-surface pressure vs. production relationhips.

The plot of producing datum or mean pres-

sure against production rate is defined as the draw-down curve. ..... (24)

The units in which the production is expressed can greatly influence the shape of the curve. This consideration will be treated later. The datum selected should be opposite the producing interval. If the well is tubed below the top of the perforations, no pressure measurements in the tubing should be used, since they do not represent the true pressure against the sand face. The zero flow, or static pressure, should likewise be measured at the producing-pressure datum.

A draw-down curve should be a plot of instantaneous pressure-rate relationships. This necessitates the adjustment of the pressures to a common time should the reservoir pressure decline appreciably during the period of the test. Measurement of static pressure before and after the producing-pressure measurements will give data for this purpose.

SPECIFIC TYPES OF DRAW-DOWN CURVES

Gross Liquid Draw-down Curve

When the production is expressed as gross barrels per day, the plot of datum or mean pressure vs. gross barrels per day is defined as the "gross liquid draw-down curve." ..... (25)

Fig. 6 illustrates the many shapes this curve can assume in different wells in California fields. When the flow in the sand is viscous, and when small free-gas volumes accompany the oil, the normal shape approaches a straight line.[9] This type of curve neglects the effect of gas in the flow of the gas-liquid mixture in the producing formation.

Many cases have been observed and published in which the draw-down curve is substantially linear in spite of conditions of high flow rates accompanied by considerable gas. Often equilibrium conditions are difficult to attain due to nearby well operations. In view of the great number of factors which influence well-performance measurements, it is surprising that linear draw-down curves are as common as they are.

Mass Draw-down Curve

H. C. Miller, E. S. Burnett, and R. V. Higgins[10] suggested the use of mass units for production in analyzing oil-well performance.

When the production (gas, oil, and water) is expressed as pounds per day, the plot of datum or mean pressure vs. mass rate of fluid production shall be defined as the "mass draw-down curve." ..... (26)

Mass rate of fluid production is expressed as pounds of gas, oil, and water per day:

And is symbolized M ..... (27)

Early work has indicated that such procedure tends toward removing the curvature of irregularly-shaped "gross liquid draw-down curves."

Productivity Index

The Productivity Index

A convenient term for expressing the relationship between producing sub-surface pressures and production rates which has come into common usage is:

Productivity index,[5] defined as the barrels per day of gross liquid produced per pound per square inch pressure drop at a specified sub-surface datum ..... (28)

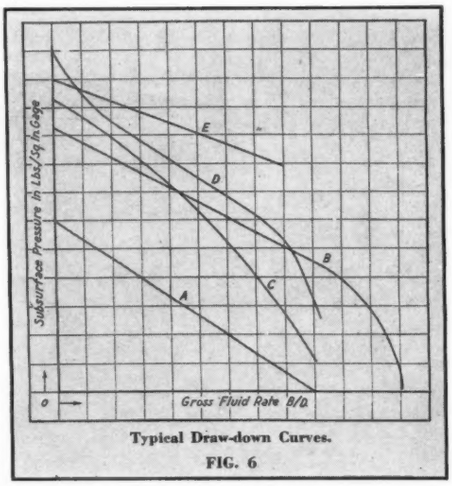
$$I_d = R_g \text{ per lb. per sq. in.}$$

where: I = productivity index.
d = datum in feet of depth.

For example, a well which produces 400 gross barrels per day with 500 lb. per sq. in. sub-surface pressure at a 4,000-ft. datum, and 600 gross barrels per day with 300 lb. per sq. in. sub-surface pressure at 4,000-ft. datum, will have a productivity index:

$$I_{4,000} = \frac{600-400}{500-300} = 1.0 \text{ gross barrels per day per lb. per sq. in.}$$

In pumping wells, where the producing fluid level is below the top of the perforations, mean pressures are preferred to datum pressures. The productivity index as defined above is useful and significant only when the draw-down curve is linear, or substantially so, and its use should be restricted to this condition. Often the draw-down curve is not linear (see Fig. 6); and in such cases the productivity index, if one were to call it by that name, would be variable with the rate of production and, if stated, would need to be qualified for the given rate at which it is determined. Linearity in draw-down curves has been observed under widely variant conditions, but it has been observed



Typical Draw-down Curves.

FIG. 6

that this condition occurs most commonly where formation free gas-oil ratios are low and where wells are in the latter stages of production.

The Mass Productivity Index

The mass productivity index is defined as the mass fluid (including gas) produced per day per pound per square inch pressure drop. Pressures may be expressed as mean pressures or datum pressures.

$$I_m = \text{M per day per lb. per sq. in.} \quad (29)$$

where: I_m = mass productivity index.
M = pounds of gas, oil, and water.

As stated in the section "Mass Draw-down Curves," the introduction of a mass production rate tends to straighten the "gross draw-down curve" in many cases. When linearity is obtained with this method, a useful term for comparative and other purposes is found in the mass productivity index.

Application of Draw-Down Curves and Productivity Indices

Specific Productivity Index

For the purposes of comparing relative productivity from area to area or from well to well, a useful term is "specific productivity,"[30] which expresses productivity per foot of perforated interval.

The production may be expressed in gross liquid or mass units, as previously stated, and the pressure may be expressed as datum pressure or mean pressure. For example:

$$C = I/L \quad (30)$$

where: C = specific productivity.
I = productivity index.
L = feet of perforated interval.

Or, $C_m = I_m/L$ ..... (31)

where: C_m = specific mass productivity.
I_m = mass productivity index.
L = feet of perforated interval.

The use of the term "feet of perforated interval" is not strictly equitable. In cases where stratigraphic knowledge justifies discrimination between productive and non-productive strata in a formation, the use of the actual feet of producing formation is to be preferred.

Estimation of Shut-In Pressures

The shut-in pressure of a well can be estimated by the extrapolation of a suitable draw-down curve to zero flow. In cases where the draw-down curve is linear, the static pressure may be calculated from an equation, in particular:

$$P_d = \frac{R_g}{I} + p_d$$

Other units as previously described may be used.

(Continued on Page 128)

WELL-PERFORMANCE TERMINOLOGY TABLE

Reference No.	Symbol	Quantity—	Definition or units—
Sub-surface Measurements:			
1	$P_{d,t}$	Shut-in pressure	The non-equilibrium pressure in lb. per sq. in.
2	P_d	Static pressure	The equilibrium shut-in pressure existing at a depth d.
3	T_d	Sub-surface temperature	The temperature, in deg. F., existing at a depth d.
4	$P_{d,R}$	Producing sub-surface pressure	The pressure at depth d when production rate is R gross bbl. per day.
Surface Production Measurements:			
5	P_t	Tubing pressure	Lb. per sq. in., gage.
6	P_c	Casing pressure	Lb. per sq. in., gage.
7	R_g	Gross production rate	Gross bbl. per day.
8	R_n	Net production rate	Net bbl. per day.
9	Q_g	Gross gas-production rate	M.C.F.‡ per day.
10	Q_c	Circulated gas-production rate	M.C.F. per day.
11	Q_f	Formation (net) gas-production rate	M.C.F. per day.
12	Q_f/R_n	Formation gas-oil ratio.	
13	Q_f/R_g	Formation gas-liquid ratio.	
14	Q_c/R_n	Circulated gas-oil ratio.	
15	Q_c/R_g	Circulated gas-liquid ratio.	
16	Q_g/R_n	Gross gas-oil ratio.	
17	Q_g/R_g	Gross gas-liquid ratio.	
18	Q_{tbg}/R_g	Tubing gas-liquid ratio.	
19	Q_{tbg}/R_n	Tubing gas-oil ratio.	
Derived Well-Performance Terms:			
20		Mean pressure	Pressure by measuring area bounded by a depth-pressure curve, the depth axis, and the two lines corresponding to the top and bottom of the formation open to the well, and dividing by the length of the perforated interval.
21	$\overline{\overline{P}}$	Mean static pressure	Lb. per sq. in., gage.
22	$\overline{P}$	Mean producing pressure	Lb. per sq. in., gage.
23		Build-up curve	The plot of datum or mean shut-in pressure vs. time.
24		Draw-down curve	The plot of datum or mean production pressure vs. production rate.
25		Gross liquid draw-down curve	The plot of datum or mean pressure vs. production rate in gross bbl. per day.
26		Mass draw-down curve	The plot of mean pressure vs. mass rate of production in lb. per day.
27	M	Mass of gas, oil, and water	Lb.
28	I	Productivity index	Bbl. per day of gross liquid produced per lb. per sq. in. pressure drop at a specified sub-surface datum.
29	I_m	Mass productivity index	Mass fluid produced per day per lb. per sq. in.
30	C	Specific productivity	Productivity index per foot of perforated interval.
31	C_m	Specific mass productivity	Mass productivity index per foot of perforated interval.
32	Pot.$_A$	Absolute potential	The rate of production which will exist when the pressure at the bottom of the producing interval open to a well has been reduced to 0 lb. per sq. in., absolute.
33	Pot.$_{d,p}$	Datum potential	The rate of production which will exist when the pressure at a specified datum is reduced to a practical minimum.
34	E_I	Installation effectiveness	The ratio of actual production to datum potential.
35	E_A	Absolute effectiveness	The ratio of actual production to absolute potential.

‡Thousand cubic feet.

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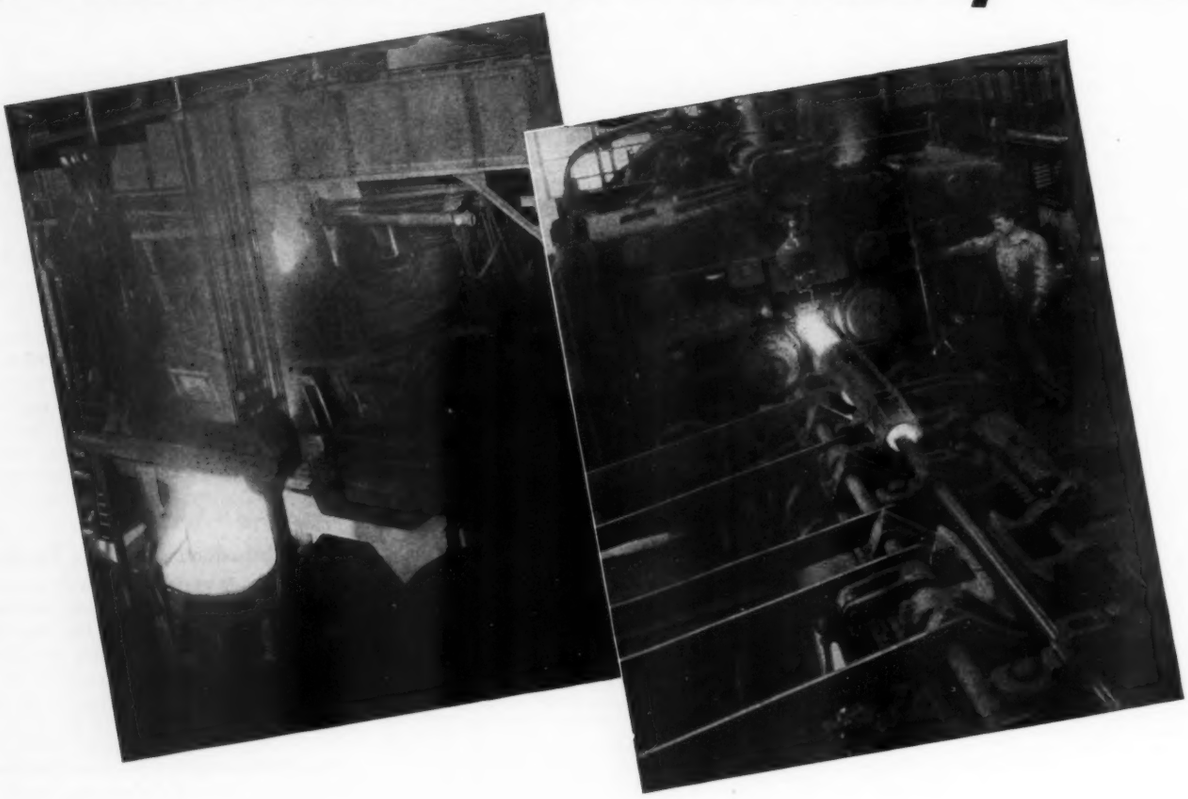

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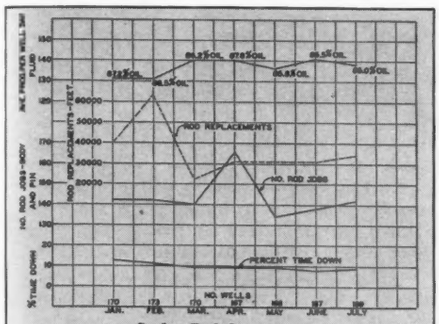
Oklahoma City Field Pumping

By B. M. MORONEY* and F. R. WHEELER†

The production at Oklahoma City is obtained principally from the Wilcox formation, a uniformly-graded sand body having an average thickness of approximately 100 feet. During the period of natural flow Wilcox-formation wells generally produced tremendous quantities of sand. Reservoir pressures have declined to 30 pounds per square inch weighted average, but the wells



Sucker-Rod Summary.

FIG. 1

still produce sand in amounts which require frequent reconditioning of the hole. The oil has a high paraffin content, and troublesome wax accumulations are encountered in producing at these low pressures. Wells having harmful quantities of free gas are becoming increasingly common; and it is not unusual to find, under static conditions, several hundred feet of frothy oil in the hole. There are also large quantities of water to be handled, particularly in some areas along the edge of the producing zone. There are approximately 640 wells in the Wilcox zone of the Oklahoma City field.

In the Simpson sand zone, which has approximately 275 wells, the problems are of a different sort. There the producing formation is a tight sand having reservoir pressures as high as 1,000 pounds per square inch in some areas. Generally the wells produce large quantities of water, and do not have appreciable amounts of free gas.

Production from other zones is relatively unimportant.

The state conservation regulations for the Oklahoma City field Wilcox zone make it advantageous for the operators to establish as large potential test flows as possible for wells above the minimum-allowable class. For minimum-class wells, the allowed production is as high as 300 bbls. per day. To be able to produce their allowables, therefore, the operators must tax their equipment to the utmost. Downtime is generally regarded as lost production.

Both the Wilcox and Simpson sands at Oklahoma City are encountered at depths of approximately 6,500 feet; and this fact, together with the problems outlined in the foregoing paragraphs, has placed secondary lifting methods at a decided disadvantage.

In the past it was a universal practice among operators in Oklahoma City to use beam pumping as a lifting method in the final stages of a well. However, the centrifugal pump and the hydraulic pump are being used with success by some of the operators. The problems and results of each of the methods will be discussed herein.

Sucker-Rod Pumping

The first pumping equipment to be installed in the Oklahoma City field was the regular standard-front long-belt and horizontal-engine type. Most of the installations in the southern part, the older part of the field, are of this type. During later months, however, the double-pitman unit pumper became the more popular. There are also a few long-stroke beam and pneumatic-head pumpers. The average beam-pumping installation including tubing represents an expenditure of approximately $11,000.

The problems encountered in sucker-rod pumping are listed as follows: sand, rod, paraffin, gas, and tubing.

Sand

Sand trouble has been the most serious problem of Oklahoma City pumping. This has been especially true of Wilcox sand wells, but has varied in different parts of the zone, as some areas seem to have less cementing material between the sand grains and, therefore, the holes cave more readily. Liners have not benefited the operators in most cases; because, where the openings were small enough to screen out the sand, they also sealed off production. Most operators have been content to pump their wells without liners.

Approximately 50 per cent of the total downtime is due to sand trouble and cleaning out of the wells.

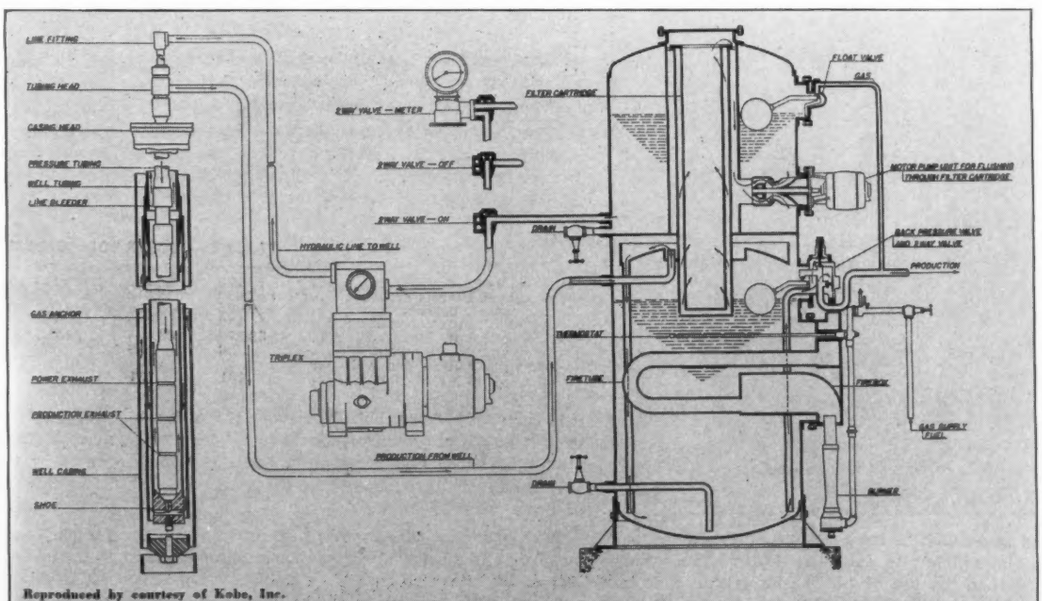
Sucker Rod

The sucker rod presents one of the most difficult and expensive aspects of sucker-rod pumping. Failure of sucker rods has been the second highest cause of downtime. Production records point to the fact that little is actually known about sucker-rod behavior. Each well seems to be a problem in itself; and it is, therefore, impossible to forecast the behavior of any given type of rod. Low-carbon non-corrosive rods are more widely used than other types of rods.

Originally the standard practice among the operators was to equip their wells with 2,500 feet of seven-eighths inch rods and 4,000 feet of three-fourths inch rods. It developed, however, that there was an excessive number of failures in the three-fourths inch section. In comparison there were fewer seven-eighths inch breaks, although the unit stress was calculated to be equal for the upper parts of each section. Obviously, the rod string failed to fall freely and was, therefore, subjected to unusual compression stresses which caused kinking of the three-fourths inch section. The greater tensile stress in the upper three-fourths inch section then caused the damaged rods to break at that point.

Another cause of sucker-rod failure, and one which also has its greatest effect in the three-fourths inch section, is the failure of the rod joint. These failures seem to occur almost entirely in the upper seven-eighths inch section, and result in damage to the three-fourths inch rods. The joint failures are located in the upper part of the string, because the loads are greater at that point. Attempts are made to eliminate trouble from this source by paying particular attention to the proper

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**



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Flow Diagram, Hydraulic Pump.

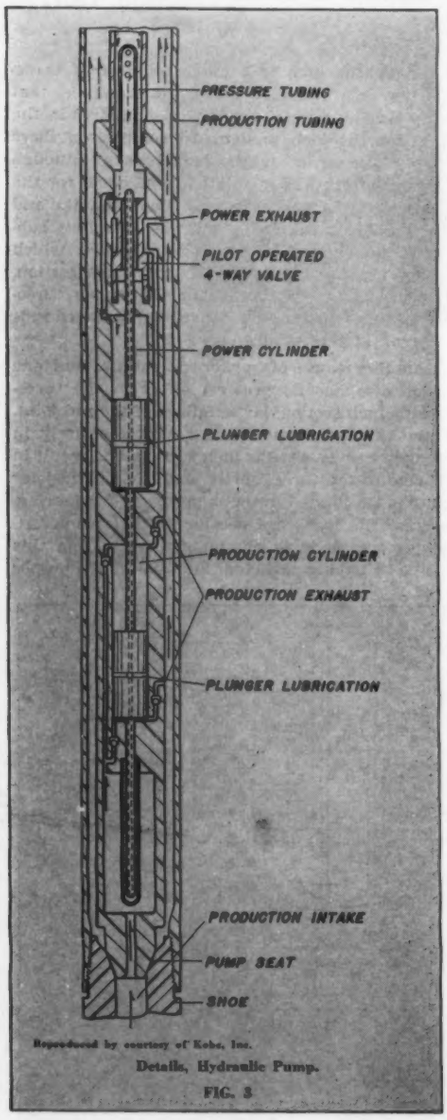
FIG. 2

*The Carter Oil Co., Oklahoma City, Okla. †Barnsdall Oil Co., Oklahoma City, Okla.

make-up of the joints. However, although much good is done in this manner, the joint failures continue to occur. Approximately 10 per cent of the rod troubles are the result of pin failures. The breaks are not entirely due to improper make-up in the field, as a substantial number of the failures occur on the factory made-up pin.

The first attempt to correct excessive breakage in the three-fourths inch section was to replace some of the three-fourths inch rods with seven-eighths inch rods. In general, the breaks continued to occur at a greater depth, but still in the upper part of their section. The next move was to run full strings of seven-eighths inch rods; but the results were discouraging in most instances, because the unit stress of the upper rods of the full seven-eighths inch strings was too great. The use of full seven-eighths inch strings also taxed the surface equipment to a greater extent, and resulted in more beam-hanger, wrist-pin, and pitman trouble.

Strings consisting of combinations of 1-inch and seven-eighths inch rods have become rather common during recent months. However, little can be said in favor of this combination, while the difficulties in fishing 1-inch rods will probably prevent their widespread use. As in the case of the complete seven-eighths inch strings, the 1-inch



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Details, Hydraulic Pump.

FIG. 3

and seven-eighths inch strings subjected the surface equipment to excessive loads. Another objection to the use of 1-inch rods is that it is impossible to fish 1-inch joint failures in 2½-inch tubing.

The replacement of damaged sucker rods is considerable, as is shown in Table 1. (See Fig. 1 for graphical presentation of data.) From the data in this tabulation, the average rod replacement was found to be approximately nine rods per month, while 40 of the wells surveyed had averaged monthly requirements of 19 rods.

Paraffin

Heavy accumulations of paraffin in the upper tubing string often decrease production, because the rods fail to operate freely. In general, however, paraffin is a minor problem in beam-pumping wells, because it can be removed readily by washing with either casinghead gasoline or naphtha, and because paraffin scrapers can be used effectively.

Tubing

Tubing generally used is 2½-inch external-upset 10 thread, and in most cases is anchored 2 feet or 3 feet off bottom. The alternate transfer of the liquid load from rods to tubing causes a corresponding elongation and contraction of the tubing. Excessive coupling wear has resulted from this movement, especially in the wells equipped with unanchored tubing. However, this wear also occurs frequently in the wells having the tubing anchors, and is probably due to faulty installation. The seriousness of this coupling wear has not been limited to loss of production only. Too often the well casing is damaged beyond repair by constant movement of the tubing, and the life of the well is shortened.

Gas

The elimination of free gas from the pump is an important factor in efficient operation. This can best be done by lowering the tubing to obtain maximum submergence. By this means the pump-intake pressures are increased, the gas tends to remain in solution, and thereby pump efficiency is rendered greater. At Oklahoma City the gas presents a real difficulty, because the average reservoir pressure has declined to approximately 30 pounds. During certain stages of development of the Wilcox zone, a "foam condition" of the oil has been experienced—resulting in major gas difficulties. In a few cases this has been overcome by raising rather than lowering the pump intake.

Downtime

As is shown in Table 1, the average total downtime on sucker-rod pumping is approximately 10 per cent. The causes of the downtime are analyzed as follows:

	Per cent
Clean-out and sand trouble	50
Rod failure	25
Other mechanical failure, engine, rig front, pump, etc.	10
Tubing failure	5
Awaiting service	8
Paraffin	2

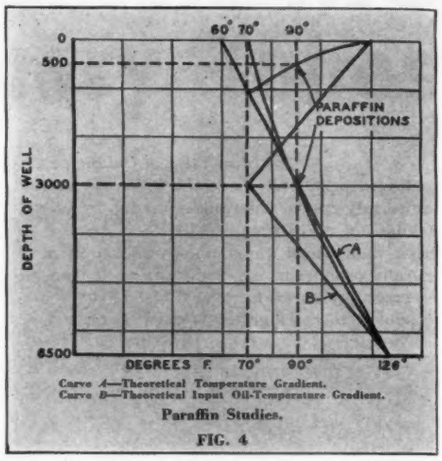
It is not likely that the average downtime can be reduced appreciably, as increased skill in operating will be offset by depreciation of equipment.

Production, as is shown in Table 1, averages 137 bbl. of fluid per well per day. It is interesting to note that the average per well per month, even in the more prolific areas of the Wilcox zone, is seldom above 6,000 bbl. However, there have been a few beam wells which have produced in excess of 10,000 bbl. per month, but these comprise but a small percentage of the total number of beam wells.

The over-all efficiency of power input to fluid output, of 15 electrically-driven beam-pumping installations, on which tests were made, averaged 27 per cent. This figure is probably close to the maximum which can be attained by this method, and it seems reasonable to believe that it is a fair over-all efficiency figure for all beam wells in Oklahoma City.

Hydraulic Pumping

At the present time there are approximately 40 hydraulically-actuated pumping units in Oklahoma City field wells. Fig. 2 and 3 show cuts of the hydraulic pump. The pump is a reciprocating-type, and is submerged in the well. It is operated by means of hydraulic power, which is generated on the surface and transmitted to the pump through a string of small tubing inserted in the regular production tubing. The power oil is heated to reduce the viscosity, and is then filtered to remove sand particles before being pumped into the well. The production unit has a direct-connected engine plunger and pump plunger. The power oil from the engine end, together with the oil from the pump end, discharges into the outer tubing string. Ordinarily the ratio of power oil to production from the well is 1 to 1. The well conditions and pump speeds can be accurately determined by the action of a pressure gage at the surface. The average cost of hydraulic-pumping installations, including tubing, at Oklahoma City is $10,000.



Curve A—Theoretical Temperature Gradient.
Curve B—Theoretical Input Oil-Temperature Gradient.

Paraffin Studies.

FIG. 4

Types of Hydraulic-Pump Troubles.

The problems encountered in the operation of the hydraulic pump are: sand, paraffin, power tubing, and mechanical troubles.

As is the case with other types of equipment, caving sand has been the greatest factor in the downtime of the hydraulic pump, as it results in pulling and clean-out jobs. It should be noted that the major portion of the hydraulic-pumping wells are located in the newly-developed north end, where sand troubles are recognized as excessive. The oil to be used as power fluid must be thoroughly cleaned; otherwise the close-fitting valve mechanism cannot function. In spite of the large percentage of downtime caused by sand, there are surprisingly few cases in which the hydraulic pump becomes so tightly wedged with sand that it cannot be removed in the usual manner. The fact that the well conditions can be determined by the action of the pressure gage makes it possible for the operators to avoid these difficult pulling jobs.

Paraffin

Although paraffin is troublesome in all of the lifting methods at Oklahoma City, it is more so in the case of the hydraulic pump. Because the accumulation takes place inside of the power tubing as well as outside, its removal is difficult. Paraffin

TABLE 1—SUCKER-ROD SUMMARY

	January	February	March	April	May	June	July
No. of wells	170	173	170	167	166	167	169
Oil produced, barrels	602,080	548,313	638,415	616,624	603,419	602,594	614,854
Oil and water, barrels	689,993	633,006	739,702	702,591	701,699	704,890	722,763
No. of rod failures, box-and-pin	142	142	140	166	134	138	142
Rod replacement, feet	39,576	63,455	22,225	30,900	31,100	30,900	33,850
Total downtime, per cent	12.6	10.9	8.8	9.0	9.0	7.7	8.9
Average production per well per day (oil and water) barrels	131	131	140	140	136	141	138

The Wiggins Pontoon Roof

THIS picture shows a row of storage tanks equipped with Wiggins Pontoon Roofs of the latest type at the Kansas City, Kansas, terminal of Socony-Vacuum's White Eagle gasoline pipe line. Wiggins Pontoon Roofs pay for themselves on working tanks handling any oil that does not boil at ordinary atmospheric temperatures. They are also used extensively on gasoline blending and treating tanks where evaporation losses, otherwise, would be excessive.

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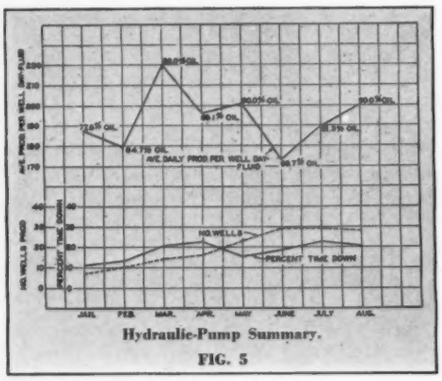
TANKS THAT STOP EVAPORATION LOSSES

CHICAGO BRIDGE & IRON COMPANY



Hydraulic-Pump Summary.

FIG. 5

has been the cause of approximately 15 per cent of the downtime of the pumps. There is reason to believe that the paraffin problem can be reduced. Until better means of overcoming the trouble are brought out, the operators are depending on solvents, inhibitors, mechanical scrapers, and steam. No system of preventing or removing the wax deposition has been found which gives more than temporary relief. The use of 500- to 1,000-gallon batches of naphtha seems to be the cheapest means of reducing the working pressure. These treatments must be repeated every one to three weeks.

Several interesting facts concerning the deposition of paraffin from Oklahoma City crude have been discovered by means of microscopic studies of oil samples under thermostatically-controlled temperatures. The results of these investigations are illustrated in Fig. 4.

The wax was found to have an affinity for the pipe when the temperatures were decreasing from 90 to 70° F. Above 90° F. the wax is in solution, and below this point it is in suspension until the temperature is again increased. These laboratory analyses bear out the observations made in the field that the paraffin deposition normally occurs between 500 feet and 3,000 feet from the surface.

Power Tubing

As it is essential that the power tubing be kept clean, it has been necessary to "pickle" and sandblast in order to remove mill scale, iron oxide, etc. Incomplete cleaning has resulted in a material percentage of the downtime. Steps are being taken at present to overcome this difficulty by more thorough conditioning of the tubing. Furthermore, when the tubing is out of the hole, the ends are capped with closed protectors to exclude dust and dirt. The handling of the small tubing is similar to that of sucker rods, and the time required to pull and run is approximately the same. One company uses the conventional sucker-rod hanger to suspend the sections of tubing in the derrick while repairs are being made. There has been comparatively little trouble from split tubing, since the working pressures are well below the bursting pressures of the tubing.

Mechanical Troubles

Mechanical troubles in the surface and bottom-hole equipment are the cause of around 10 per cent of the downtime. As the pump is sensitive to starting conditions, it requires particular care at that time. Because the equipment is new to the oil fraternity, it is necessary to train the operating force at the time of the pump's installation; and because this method of pumping oil is a radical departure from conventional methods, there is much to be learned by the operators concerning its use. Therefore, it is reasonable to assume that mechanical difficulties will be overcome to some extent as experience is gained.

The average fluid production of the hydraulic pumps at Oklahoma City is 194 bbls. per day, as shown in Table 2. (See Fig. 5 for graphical presentation of data.) It is evident that, although the total downtime of hydraulic pumps heretofore has been greater than that of beam pumps, the average daily production has also been greater. These features have tended to equalize the monthly production by each method.

Hydraulic Downtime

The average downtime of the hydraulic pump has been approximately 18 per cent. The various causes of downtime are summarized as follows:

	Per cent
Clean-out and sand	50
Paraffin	15
Mechanical troubles	10
Awaiting service	10
Dirt in power oil	10
Tubing leaks	5

As most of the hydraulic power is generated by means of electricity, it is a simple matter to calculate the over-all efficiency of the units. The efficiency, expressed as power input to fluid output, averages approximately 60 per cent, a figure which is considerably greater than that for other methods.

Submerged Electric Centrifugal Pumping

In the electric centrifugal-type pumping, the motor and pump are suspended on the tubing, and are submerged in the well. Fig. 6 shows cuts of the centrifugal pump. Power is transmitted to the motor by means of a cable, which is clamped to the tubing string. The centrifugal-pumping installation represents an investment of approximately $13,000, which includes motor, pump, cable, etc. Costs of operation per day are high, but per-barrel costs are commensurate with other lifting methods.

The centrifugal pump has been used to advantage at Oklahoma City as a temporary successor to gas-lift.

The practicability of a centrifugal installation depends upon the following factors: sand, gas, and productivity of the well.

Sand and Gas

Sand particles are particularly hazardous to the centrifugal pump. It rapidly wears away the impellors, and slippage becomes excessive. Wells thus equipped usually require more cleaning out than those with other types of equipment, because higher rates of flow wash more sand into the hole.

In gassy, frothy oil the centrifugal pump is decidedly handicapped. Fluids of less than 20 pounds per 100 feet are common in the field. It has been found that the centrifugal pumps ordinarily fail to operate under these conditions. Certain centrifugal gas-lift installations, however, are able to handle this light oil, because the pump operates with a lower discharge head.

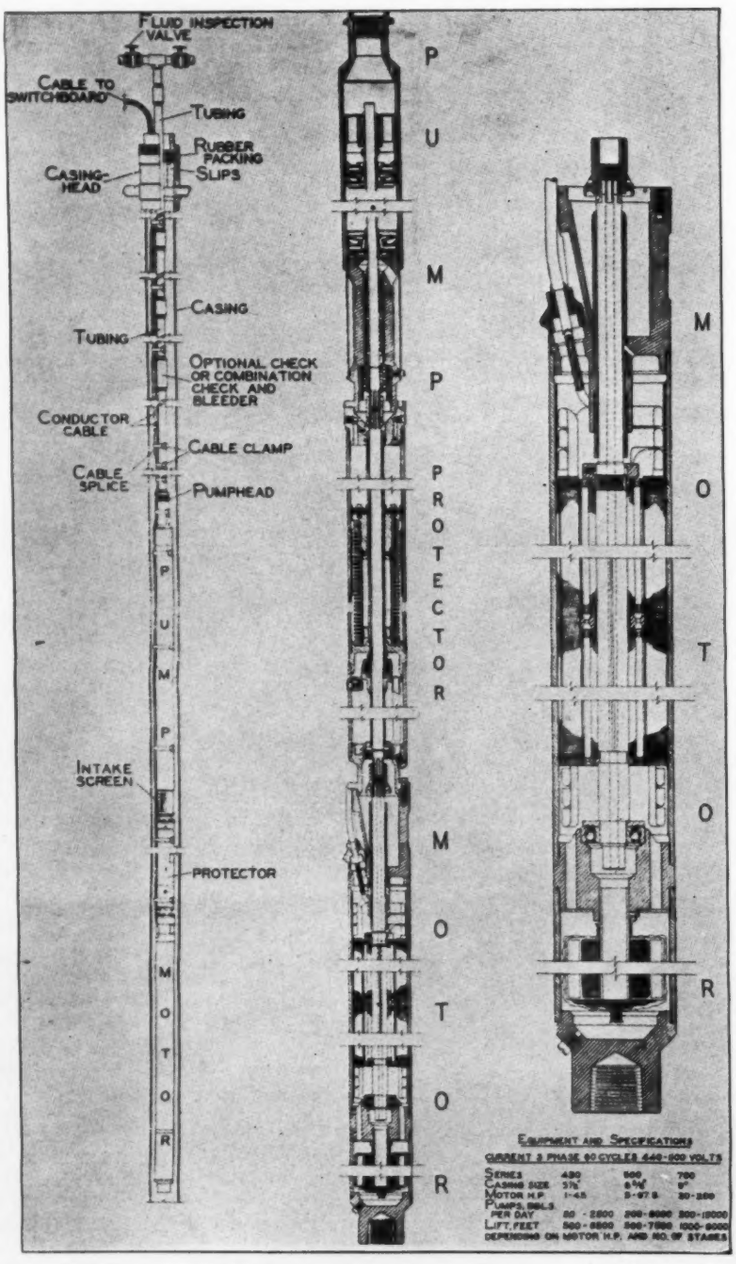
To date the centrifugal pump is essentially a high-capacity unit, and its use has, therefore, been limited to large wells. Attempts are being made to develop a unit capable of production as low as 200 to 300 bbls. per day, but as yet the results are economically unsatisfactory.

At the present time there are upwards of 150 centrifugal pumps in operation in the Oklahoma City field, about one-quarter of which are in Simpson-zone wells. The Simpson wells generally produce at least 50 per cent salt water, and are usually free of any loose sand. Ordinary runs in wells of this type are approximately 60 per day. Longer average runs are obtained in Simpson-zone wells, because there is less sand produced by these wells.

Downtime

The downtime of wells equipped with centrifugal pumps is generally considerably greater than that of other lifting methods. The high percentage of mechani-

(Continued on Page 127)



Reproduced by courtesy of Reda Pump Co.

Reda submergible electrical centrifugal pump.

Figure 6

Wiggins Breather and Balloon Roofs

WIGGINS Breather and Wiggins Balloon Roofs reduce evaporation loss by providing space in which vapor can expand and contract without venting gas or drawing in air. Wiggins Balloons also utilize this same flexible steel diaphragm construction principle in serving as large capacity gas holders for vapor saving systems. The Balloon Roof tank pictured at the right is located in Brockville, Ont. The new Breather Roof tanks below are part of a recent installation in Houston, Texas.

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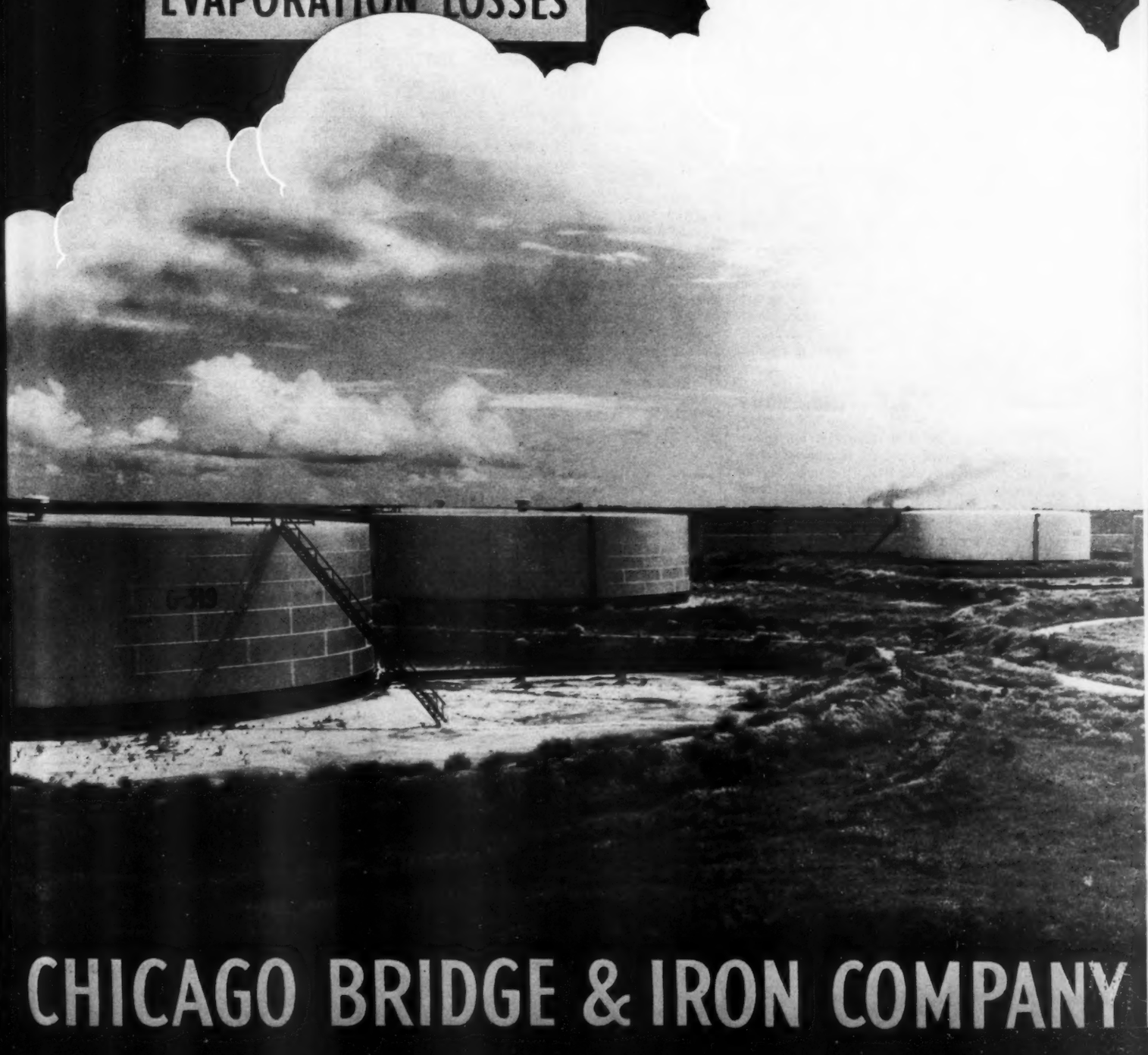
Plants at Birmingham, Chicago, Greenville, Pa.

TANKS THAT STOP EVAPORATION LOSSES



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One Way of Finding Oil More Cheaply

By PARKER D. TRASK*

In the United States we are now taking oil from the ground at a rate of more than one and a quarter billion barrels a year. At present we know where there are about 13 billion barrels of oil that can be produced by current methods of operation. This does not, however, represent our entire supply of oil, as we are finding new fields all the time. Thus far we have been able to locate

Chart Showing Cost of Dry Holes in the United States for the Past Five Years. Based on an Average Cost of $15,000 Per Well.

FIG. 1

(Figures 2, 3, 4, 6 and 10—photographs—omitted)

as much new oil each year as is taken from the ground during the year. Can we keep this rate up? This year (1937) we shall probably produce about 200 million more barrels of oil than last year. Shall we find that much more oil than we did last year? If so, we have to discover more oil fields than we did last year.

There is just so much oil in the ground. All the oil that will be used in our lifetime has already been formed and is awaiting discovery. Each new field found, therefore, lessens the number of fields yet to be discovered. The fields that are easy to find have already been located. The hard ones remain. Locating new fields costs a great deal of money. Last year at least 80 million dollars alone was spent on dry wells—on wells that yielded no oil (Fig. 1)—not to mention the cost of geological and geophysical exploration before the wells were drilled. This 80 million dollars spent on barren wells is money wasted, unless the information obtained from the dry holes helps in finding favorable locations for the next wells. Any information that will lessen the number of dry wells drilled will decrease the cost of locating new oil pools and thus make it cheaper to find oil. One way of cutting this cost of discovering petroleum is to obtain more adequate knowledge of the occurrence and character of source beds from whose organic matter petroleum has originated.

Three Essentials For An Oil Pool

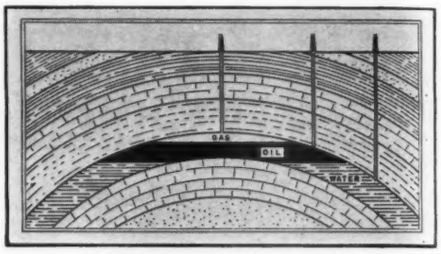
Source beds are one of the three requisites for an oil pool. The other two are reservoir rocks and traps. Oil is found in the ground, and it is generated in the ground from substances present in certain types of rocks. As it consists of carbon compounds, it has to be derived from carbon compounds present in such rocks. The main sources of these carbon compounds are organic substances—remains of plants and animals—that accumulate at the time the rocks are formed. Rocks that contain carbon compounds suitable for the formation of petroleum are sedimentary rocks, which are composed of particles of sand, silt, or lime that are laid down in some body of water.

Silt and sand carried by streams settle out of the water when the stream enters the ocean

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

or some other body of water, such as a lake or lagoon. At the same time that the particles of sand and silt are being deposited, remains of plants and animals that live in the water also gather in the sediments. Year after year the sediments accumulate near the mouths of rivers; and if the ground sinks as the sediments are deposited, several thousand feet of deposits may be laid down. In time the sediments may become hardened into rock. Deposits of sand are changed into sandstones, and deposits of silt are converted into shales. In some places of deposition of sediments, such as along the southern end of Florida, the streams transport little sand or silt to the sea, and particles of lime accumulate on the sea bottom. Such limey deposits when hardened are transformed into limestones.

Any of these three types of sedimentary rocks—sandstones, shales, or limestones—may be source beds; i.e., under proper conditions, the organic substances they contain may be transformed into petroleum. However, not every sandstone, shale or limestone is a source bed, and not every type of

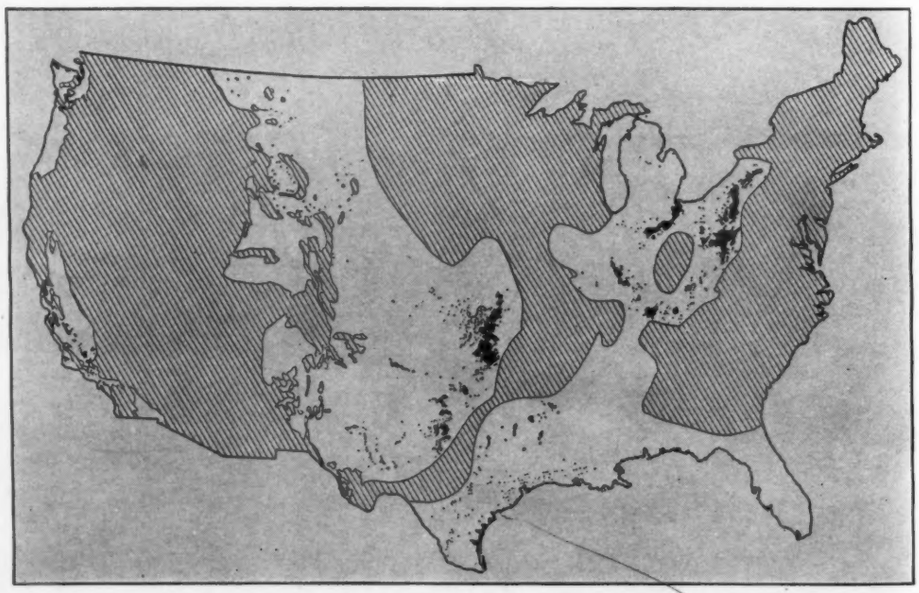


The oil is generated in a disseminated form in the rocks, and moves gradually through them until it reaches a suitable reservoir rock. As the open spaces in the reservoir rock are filled with water when the oil gets to them, the oil, being lighter than the water, rises until it reaches the overlying strata that do not permit the passage of oil through them. It gradually collects until a pool forms on the top of the anticline, where it can go no higher. The gas, being lighter than the oil, overlies the oil. A well drilled at the crest of the anticline, therefore, may yield gas; one slightly off the crest produces oil; and a third well farther down on the flanks gives only water.

Diagram of anticline showing one way in which oil accumulates.

Figure 5

organic constituent in such sedimentary rocks can be converted into oil. As petroleum is a very special substance, only certain types of organic materials can be changed into petroleum, and then only under proper conditions of heat and pressure. The



The unshaded parts of map represent areas in which oil may possibly be found, although oil will be found in only small parts of these areas. Shaded parts of the map indicate areas in which the chances for finding oil are not favorable.

Map of the United States showing oil fields (black) and areas now unproductive, classified with respect to their likelihood of yielding commercial quantities of oil (after Geological Survey).

Figure 7

*Geological Survey, U. S. Department of the Interior, Washington, D. C.; director, A.P.I. Research Project 4. Published by permission of the director, Geological Survey.

types of organic substances that can be transformed into oil, the conditions under which such substances collect in sediments, and the ways by which they are converted into oil are not well known.

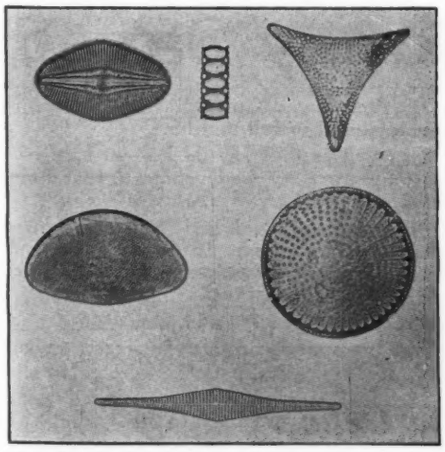
We do, however, have some information about the conditions of formation of oil. We have reason to believe that oil generally is formed from organic substances laid down in sediments that accumulated near the seashore, either in the sea or bays and lagoons, rather than in lakes or in the ocean far from shore; that the mother substances have to accumulate in stagnant water in which little dissolved oxygen is present; that the rocks should not be subjected to too much heat or pressure while the oil is in the process of forming, and that oil as a rule probably accumulates somewhere near its place of origin. However, we do not have any diagnostic criteria for recognizing oil-making rocks, i.e., we cannot take any particular sandstone, shale, or limestone and say with certainty whether or not it is a source bed.

The question of source beds is intimately associated with the two other requisites for an oil pool—the reservoir and trap. The oil is generated in the source beds in a very disseminated form and, in order to collect in sufficient quantities to form a commercial pool, has to gather and become trapped in a suitable reservoir.

The reservoirs in which the oil accumulates are in rocks that contain open spaces or cavities. In contrast with source beds, the various kinds of reservoirs are well known. They consist of three types: 1, in which the cavities are formed by solution of the rock, as in many limestones; 2, in which the cavities are formed by breaking or fracturing of the rocks; and, 3, the most common, in which the spaces or cavities are around the grains of sand in a sandstone, much like the spaces around bird-shot in a glass.

Oil is a mobile substance, and to keep it from escaping a suitable trap is required. The different types of traps that prevent the escape of oil, like the different kinds of reservoirs, are also well known. The main type is the anticline, which is illustrated in Fig. 5. Another kind is the salt dome. Numerous other types are known, but they need not be discussed here.

If one of the three requisites—source beds, reservoir, and structure—for the formation of an oil pool is lacking, no pool of commercial value will form. However, in trying to locate new pools



Diatoms are minute plants that live in water, and have skeletons of a glassy substance called silica. They vary considerably in size, but most of them are 1/1,000 to 2/1,000 of an inch in diameter. Diatoms are one of the basic supplies of food for animal life in the sea, and are one of the ultimate sources of petroleum. Like land plants, they depend upon sunlight and mineral substances for growth but, unlike land plants, they do not have woody or fibrous skeletons or roots. They float in the water, and are easily transported by currents. The water they live in supplies the substances they need for food. Photograph by K. E. Lohman of the Geological Survey.

Fossil marine diatoms as seen under a microscope.

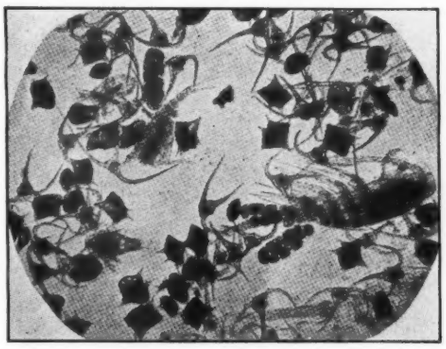
Figure 8

oil operators lay emphasis first on structure, second on reservoir, and last on source beds.

In regions such as the Los Angeles Basin of California or the Mid-Continent oil area of Oklahoma and Kansas, where adequate reservoirs and source beds are known to be present over such an extensive territory, the main consideration, of course, is structure. But how about areas in which no oil has yet been found? Are reservoir rocks and source beds present in them? As illustrated in Fig. 7, there are large areas in the United States in which no oil has yet been discovered, but which are regarded as possible productive regions. It is certain that in many parts of this possible productive territory no oil will be found. At the present time much of this territory, however, is being prospected for oil; in fact, some of the places which are being considered are probably deficient in source beds. If the companies could tell by the analyses of well cuttings that source beds were lacking, they could save millions of dollars in further useless drilling. On the other hand, if the cuttings indicated that adequate source material is present in certain places, they could make their exploration campaign much more efficient by concentrating on those particular places. In other words, if the oil companies could recognize source beds as effectively as they can reservoir rocks and structural traps, they would certainly carry on their prospecting campaign more profitably.

Research on Source Beds

The American Petroleum Institute recognized



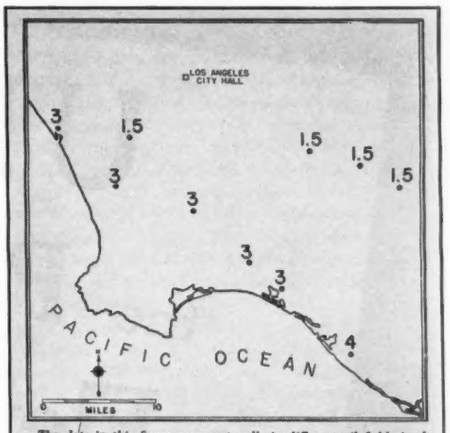
This picture is a photograph of a concentrated mass of plants and animals living in the surface waters of the sea. The three-horned objects, and also the square-shaped things, are peridineans. Like the diatoms, the peridineans—dinoflagellates as they are sometimes called—are one of the basic sources of food in the sea but, unlike diatoms, they have no hard skeletons of silica. The objects that look something like shrimps are copepods. Copepods are one of the many types of animals that feed on peridineans and diatoms, and in turn are important foods of fishes. The copepods, although larger than the peridineans, are so small that they can barely be seen with the naked eye. Photograph by H. B. Bigelow, supplied through the courtesy of U. S. Bureau of Fisheries.

Peridineans and copepods as seen under a microscope.

Figure 9

in 1926 the need for adequate knowledge of mother substances of oil, and sponsored a research investigation of source beds. This work has been carried on ever since; and in 1931 the U. S. Geological Survey joined with the Institute in supporting it.

The information available in 1926 seemed to indicate that the most important steps in the investigation of source beds were to ascertain: 1, how the remains of plants and animals get into sediments; 2, what happens to them while they are being deposited in the sediments and after they get there; 3, how the organic materials in the recently-accumulated sediments differ from the organic substances in the sediments, millions of years old, which are associated with the oil zones in different types of oil fields; and 4, how the organic substances in the sediments near oil zones differ from those in sediments far from oil zones. Such a course of investigation would indicate something about the processes by which oil is formed, and might lead to the development of diagnostic tests for source beds; for, if the sediments near oil zones were found to differ in some fundamental



The dots in this figure represent wells in different oil fields in the Los Angeles Basin. The numbers beside the dots indicate the average percentage of organic matter in the lower Pliocene sediments, which are regarded as one of the main sources of the oil.

Map of the Los Angeles Basin in Southern California, Showing the Variation in Organic Content of Some of the Sediments.

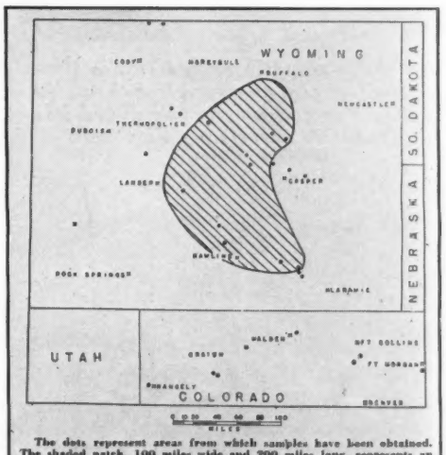
FIG. 11

property from the sediments far from oil zones, that particular property might prove to be a means of recognizing source beds.

The work, therefore, began with a study of the conditions under which remains of plants and animals collect in marine and brackish-water sediments. Five years were devoted to this phase of the subject, and nearly 2,000 samples of sediments from many parts of the world were collected and studied. Following this, samples of rock strata from many parts of the United States were considered. This work is still continuing, and to date more than 30,000 samples of rock cuttings and cores from wells in nearly every oil-producing state in the Union have been investigated. The story of this work is too long to relate here. In fact, approximately 50 publications, including a book, have been printed about it. All that can be given is a summary of some of the main results that have been obtained.

The basic source of the organic substances in marine sediments was found to be mainly the small microscopic plants that live in tremendous numbers near the surface of the ocean. Each quart of water in the upper two or three hundred feet of the ocean contains from a few thousand to several million of these microscopic organisms. The main types are illustrated in Fig. 8 and 9.

These organisms are eaten by animals in the



The dots represent areas from which samples have been obtained. The shaded patch, 100 miles wide and 200 miles long, represents an area in which the organic content of the sediments correlated with the Mowry shale is approximately constant. The extreme variation in this shaded area is less than 40 per cent.

Map of Wyoming Showing the Variation in Organic Content of Some of the Sediments Regarded as Favorable Sources of Oil.

FIG. 12

sea; but marine animals, like any other animals, cannot digest everything they eat, so they excrete what they cannot digest. Most of these undigestible

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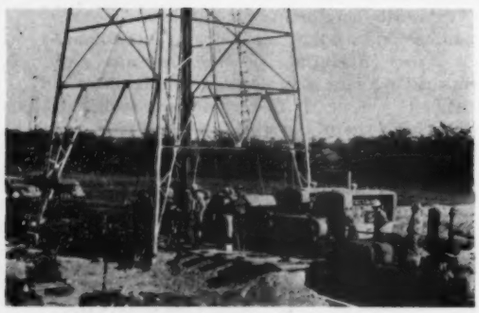

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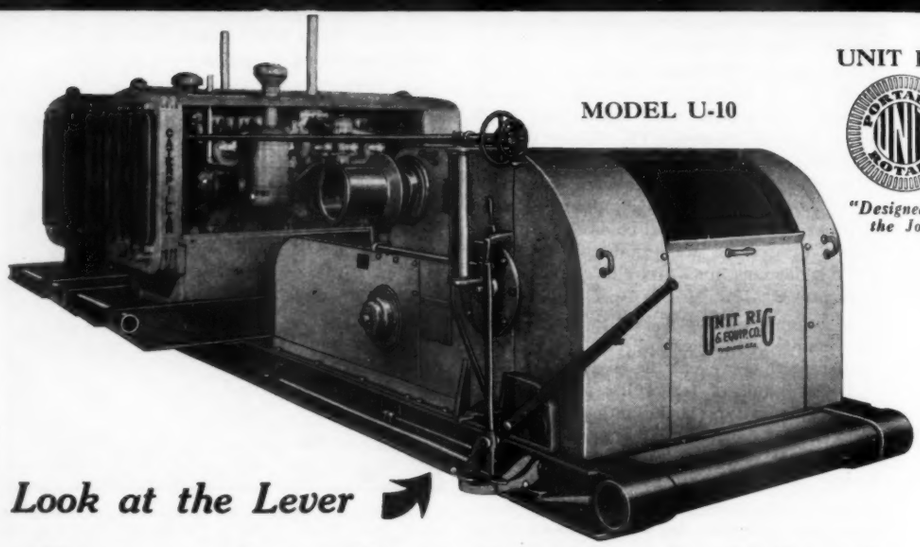

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residues ultimately sink to the sea bottom and become buried in the sediments. Some of the microscopic organisms, instead of being eaten by animals, are attacked by bacteria, or germs, and the parts of the organisms the bacteria cannot destroy likewise sink to the sea bottom, where, together with the rest of the organic matter that has accu-

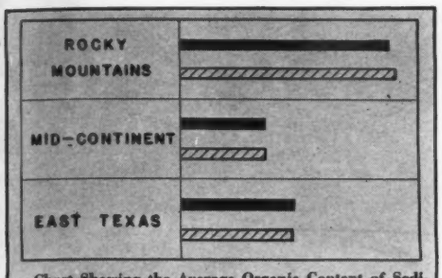

Chart Showing the Average Organic Content of Sediments Near (Black Bars) and of Those Far (Shaded Bars) from Oil Zones.

FIG. 13

mulated in the sediments, they are attacked by other bacteria or eaten by bottom living animals, and still more unutilizable residues are formed. This process continues until no more nutriment can be extracted out of the organic matter by any type of organism that can live in the sediments.

These organic residues tend to collect in depressions in the sea floor. Organic matter has nearly the same density as sea water, and is easily carried by currents. It is, therefore, deposited in the sediments in places where the water is quiet, such as in the bottoms of basins on the sea floor. Silt and clay particles in suspension in the sea water likewise tend to be laid down in basins —with the result that sediments, such as shales, which are composed of fine particles, are likely to contain more organic matter than sandstones, which consist of coarse particles and, therefore, are apt to be richer in source material. This inference is supported by the studies of the samples of rock strata from the different oil fields. The shales were usually found to be much richer in organic matter than the sandstones.

Oil almost certainly is not formed while the sediments are soft and in the process of accumulation. No trace of petroleum was found in any of the sediments that were collected from the sea bottom. Oil evidently is formed sometime after the

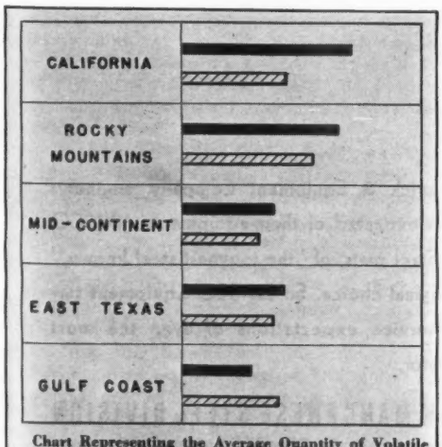

Chart Representing the Average Quantity of Volatile Material in the Organic Substances in the Sediments Near (Black Bars) and in Sediments Far (Shaded Bars) from Oil Zones.

FIG. 14

sediments are laid down, perhaps millions of years later. The sediments in practically every known oil field are at least 10 million years old, and in some fields are more than 300 million years old.

The different types and quantities of organic constituents of sediments give some clues as to what particular materials are sources of oil. The general quantity of organic matter in near-shore marine sediments is about 2.5 per cent. Some sediments, such as those now accumulating off the coast of Southern California, contain as much as 7 per cent; whereas others, such as some along parts of the Atlantic Coast of the United States, contain about 1 per cent. The sediments, after they have been transformed to rock strata, lose some of their organic matter. Different sediments undoubtedly lose different proportions, but the average amount seems to be about 1 per cent of the total weight of the sediment, or 40 per cent of the weight of the organic substances in the sediment.

Not all of this material that is lost is converted to oil; in fact, as mentioned above, none of the organic constituents in some sediments has been transformed into oil. In areas where oil is generated in the sediments, it is difficult to estimate the proportion of the organic constituents that has been converted into oil. The quantity, however, probably is 5 to 10 per cent of the original quantity of organic matter deposited in the sediments, as shown by the results of this investigation of source beds.

Substances such as fats and cellulose (fibrous or woody materials) form less than 1 per cent of the organic constituents of the sediments that have been studied. Since at least 5 per cent of the organic content of the sediments seems to be changed

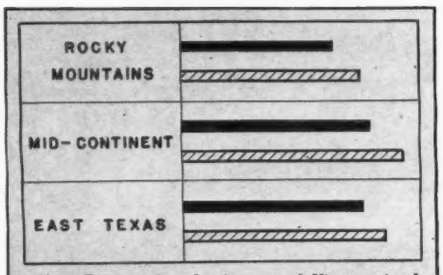

Chart Representing the Amount of Nitrogen in the Organic Constituents of Sediments Near (Black Bars) and of Those Far (Shaded Bars) from Oil Zones.

FIG. 15

to oil in the process of formation of oil, fats and cellulose apparently are present in sediments in too small proportions to be important sources of oil. Petroleum evidently comes from the complex organic compounds that form the main part of the organic constituents.

Studies of Drill Cuttings

The investigation of the many thousands of samples of rock cuttings from wells has indicated that ancient sediments, like modern sediments, contain a small amount of organic matter. The average quantity is about 1.5 per cent of the weight of the rocks, and few sediments contain more than 5 per cent. The work also seems to indicate that unless the sea bottom is deformed by earth movements during the deposition of the sediments, the quantity of organic matter in the sediments changes slowly and at a fairly uniform rate from place to place. For example, as illustrated in Fig. 11 and 12, in areas such as the Los Angeles Basin, which was a region of active movement of the earth's crust at the time the sediments were laid down, the organic content of some of the sediments doubles within 15 miles; whereas in certain sediments in Wyoming the organic content hardly changes appreciably over a distance of 100 miles.

Means of Recognizing Source Beds

Several properties of the sediments have been investigated as to their effectiveness as means for recognizing source beds. Most of the properties studied, however, did not give particularly promising results; in fact, only one seems especially encouraging.

The quantity of organic matter in the sediments was thought possibly to be an index of source beds, but the results of the work indicate fairly conclusively that it is not. As shown in Fig. 13, the average organic content of sediments, both near and far from oil zones, is the same in each of the areas for which data are available. Many sediments that contain much organic matter, as indicated by their geological relations, do not seem to be good source beds, and many other sediments that contain little organic matter have been the source of oil in very productive fields. On the other hand, many sediments poor in organic matter equally certainly have yielded no oil, and a large number of sediments rich in organic matter have been the source of oil for oil fields. The conclusion is almost inevitable that it is quality of organic matter, not quanity, that counts.

The color of sediments has been regarded by many geologists as a guide to source beds: dark-colored sediments have been thought of as being better source beds than light-colored sediments. Upon investigation the color was found to vary roughly with the quantity of organic matter in the sediments; light sediments were observed generally to be poor in organic matter, and dark sediments to be rich. However, as the quantity of organic matter is a poor index of source beds, the color is presumed likewise to be a poor index.

Petroleum consists of compounds that are rich in volatile substances, i.e., substances that can readily be changed to a gaseous form by heating. Consequently, it was thought the amount of volatile substances in the organic constituents of the sediments might possibly prove to be an index of source beds. However, as indicated in Fig. 14, the proportion of volatile substances in the organic constituents seems to be only a fair index.

Petroleum likewise is deficient in compounds containing nitrogen. Sediments in which the organic constituents are low in nitrogen, therefore, might prove to be source beds. As illustrated by Fig. 15, a slight relationship was found but, like the relationship for the volatility, was not observed to be sufficiently consistent to be especially promising.

The only property that is particularly encouraging is the nitrogen-reduction ratio. The nitrogen-reduction ratio is the ratio of the quantity of nitrogen in the sediments to the quantity of chromic acid the sediments can reduce. Chromic acid, when added to sediments, is reduced; i.e., it loses some of the oxygen it contains. A chemical reaction takes place whereby the oxygen that is given off by the chromic acid enters into chemical combination with some of the constituents of the sediments and

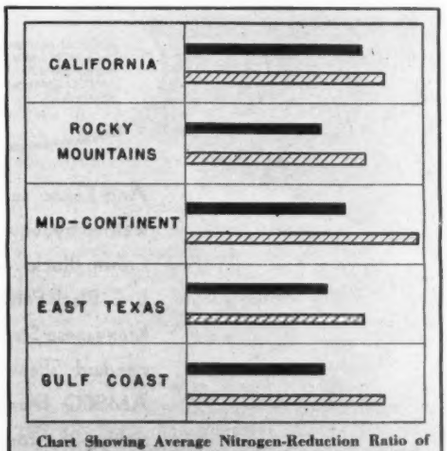

Chart Showing Average Nitrogen-Reduction Ratio of Sediments Near (Black Bars) and of Those Far (Shaded Bars) from Oil Zones.

FIG. 16

thus increases their oxygen content. Constituents that have thus been increased in oxygen content are said to have been oxidized. The chemical reaction whereby oxygen is lost from the chromic acid takes place only under the condition that the constituents of the sediments can increase their oxygen content. If they already contain much oxygen, little chromic acid is reduced; and, if they

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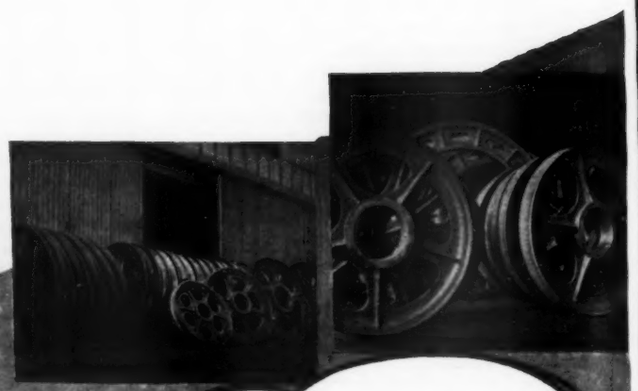

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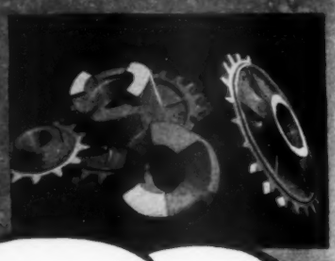

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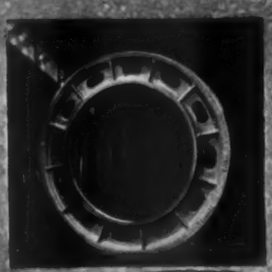

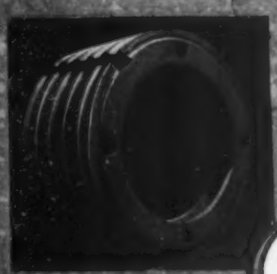

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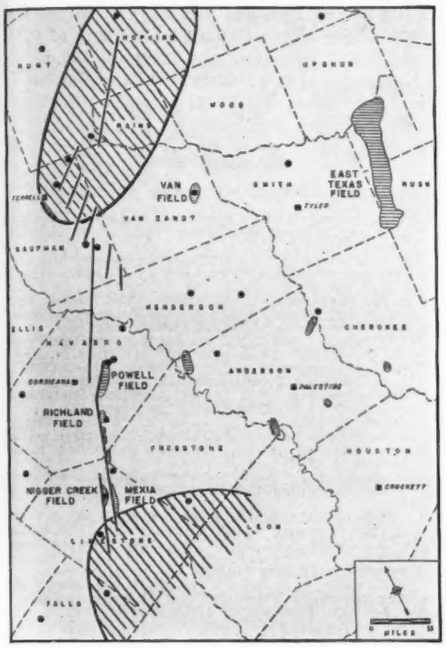
have a low oxygen content, considerable chromic acid is reduced. Most substances that are oxidized in the sediments are organic compounds rather than mineral constituents; so if much chromic acid is reduced by the sediments, the organic constituents may be presumed to contain relatively little oxygen. As petroleum is composed of compounds that contain almost no oxygen at all, the sediments that generate it might likewise be expected to contain little oxygen. Since the quantity of chromic acid that is reduced forms the denominator of the nitrogen-reduction ratio, source beds, therefore, might be expected to have lower ratios



Dots represent wells from which samples have been obtained. Patches shaded with diagonal lines represent areas in which the nitrogen-reduction ratio of the Eagle Ford shale, which is regarded as one of the main sources of oil in this region, is relatively high. Areas shaded with horizontal lines represent oil fields in which oil is found in the Woodbine sands. Heavy lines represent faults.

Map of the East Texas Basin showing areas in which the nitrogen-reduction ratio is high.

Figure 17

than non-source beds. Also, as discussed above, a low nitrogen content seems to be a slight indication of the ability of the sediments to generate oil. Consequently, as nitrogen is placed in the numerator of the nitrogen-reduction ratio, low ratios should be expected even more strongly to be favorable indices of source beds.

As illustrated in Figure 16, low nitrogen-reduction ratios have been found to be fairly good indices of source beds. In each of the five oil regions indicated in Fig. 16, California, Rocky Mountains, Mid-Continent, the East Texas Basin, and the Gulf Coast, the ratio has been found to be distinctly lower for the sediments near the oil zones than for the ones far from oil zones. Preliminary compilations of the results from the Appalachian petroliferous province likewise seem to indicate that low ratios are favorable indices of the ability of the organic matter in sediments to form oil in that area.

The Eagle Ford shale in the East Texas Basin is generally regarded as one of the sources of the oil in this area, and lies immediately above the Woodbine sand, which is the main producing zone in this region. On the west side of the basin, oil accumulates along a number of the faults—planes along which the strata have been broken—south of Corsicana, but not along the faults north of Corsicana. Several possible explanations have been offered for the absence of oil in the Woodbine sand north of Corsicana, such as: 1, inadequate traps; 2, generation of the oil so long before the period of faulting that it had dissipated by the time the faults had formed; or, 3, lack of source beds. The Eagle Ford shale has low nitrogen-reduction ratios almost everywhere, but in the barren region north of Corsicana it has relatively high ratios. The presence of the high ratios suggests that perhaps inadequate source beds are one of the reasons why the fault structures north of Corsicana are barren in the Woodbine sand.

The nitrogen-reduction ratio, however, has not yet proved to be a completely reliable index of source beds. A number of exceptions have been observed. A few sediments with high ratios have been found which, from their close association with oil, seem to be good source beds, and likewise some sediments with low ratios apparently are poor source beds. At present the ratio seems to be 65 to 75 per cent efficient. It is still far from being thoroughly understood, although it does offer considerable promise. In fact, one oil company reports saving $100,000 in leases it would otherwise have purchased in the vicinity of a wildcat well had not the cuttings from the well had very high ratios. The well was located on good structure, and ultimately proved to be dry.

The nitrogen-reduction ratio is much like radium or the X-ray, which cure some but not all cases of cancer. Everybody will admit that even though radium or the X-ray are not 100 per cent perfect, they are very useful for some types of cancer. The nitrogen-reduction ratio similarly offers considerable promise in the study of source beds; but, just as more research is still needed on radium and cancer, so additional research is still needed on the nitrogen-reduction ratio to learn more fully its usefulness and limitations. Meanwhile it looks as though the use of the ratio will save the industry money in prospecting for oil.

Years of effort were required before knowledge existed that would permit presentation of this paper. We realize that the research is far from ended, that much remains to be done; but, nevertheless, definite and useful results now are available. We might compare this research to the progress of the development of the seismograph, with which oil men now are so familiar. We all know that even today it is far from perfect, but no one can deny that it can be helpful and promises to be more so in the future. The idea that wells could be completed by shooting steel bullets through pipe and cement probably would have seemed outrageous to early pioneers, but the research that made this completion procedure possible has now been justified. The idea that equipment could be designed to drill to a depth of 12,000 ft. probably seemed fantastic 50 years ago, but today it causes no comment. It is our hope and belief that methods by which promising areas for prospecting for oil can be definitely separated from uninteresting areas will at no remote date take their places as accepted and valuable parts of the business of discovering oil upon which our well-being depends.

Oklahoma City Field Pumping

(Continued from Page 118)

cal downtime is increased somewhat, because it is necessary to send the unit to the factory to make all repairs and replacements. Ordinarily the operators have one replacement unit to every two or three wells.

The over-all mechanical efficiency of the centrifugal pumps at a depth of 6,500 feet has been found to be approximately 36 per cent.

Combination Electric Centrifugal—Gas-Lift and Hydraulic—Gas-Lift Pumping

Continuous gas-lift, although it utilizes an artificial means of producing fluid, has been omitted in this discussion, because it is not considered a pumping operation. Neither is it being used to any extent at Oklahoma City at the present time except in producing some of the higher-pressure Simpson-zone wells. Certain phases of gas-lift are worthy of consideration, however.

Considerable progress has been made in gas-lift operations in conjunction with both the electrical centrifugal and the hydraulic pumps. These combination gas-lift pump methods are similar in that both the centrifugal and hydraulic pumps lift the well fluid a few hundred feet to a point above a packer, from which it is carried to the surface by compressed input gas. The reduction in discharge head enables the pump to handle more fluid than would otherwise be possible.

Centrifugal—Gas-Lift

The centrifugal pump in combination with gas-lift has met with phenomenal success in producing the low-pressure Wilcox wells. It was found that as much as 5,000 to 6,000 bbls. per day could be lifted when the bottom-hole pressure was as low as 50 to 60 pounds per square inch. Consequently, the method came into wide use in establishing potential flows. Best operation was obtained in wells which were cased with 8⅝-inch or larger casing, as this enabled the operator to use as large diameter pump as possible, and at the same time gave more efficient gas-lift flow.

Wells in which excessive gas caused the oil to be in a foamy state, or wells which had loose sand, are less suited to this type of operation than those having heavier fluid and little sand.

Paraffin solvents were found to be the most successful means of overcoming troublesome wax deposition in the casing, and it is necessary to pay strict attention to the proper treatments in order to avoid serious difficulties.

The length of service obtained between repair jobs depends principally upon the amount of sand produced with the oil as well as upon factors which affect the electrical equipment. Runs vary from a few hours to several weeks.

Hydraulic—Gas-Lift

The hydraulic pump in connection with gas-lift is a relatively new experiment which shows promise of being extended in the future in handling large volumes from low-pressure wells. Under this system it becomes possible for the operator to install equipment after the period of continuous gas-lift which can be used throughout the entire productive life of the well.

In the hydraulic-pump and gas-lift method a larger than usual pump is connected with a regular-size fluid engine. The pump is run on 250 to 500 feet of 5-inch casing, inside of which the power tubing is installed. Both casing and power tubing are run simultaneously. A hydraulic-type packer is then installed, and the entire unit is lowered into the well on 3-inch tubing. Power tubing is then inserted in the 3-inch tubing, and is seated in a shoe in the packer assembly. Compressed gas is introduced at the surface in the 3-inch tubing, and enters the well casing above the packer. The power oil flows through the 1¼-inch tubing, actuates the pump, and joins the oil from the well produced between the tubing and casing.

Production of 1,000 to 2,000 bbl. per day has been obtained by this type of lift without operating the units at capacity. The ratio of input gas required per barrel of oil produced ranges from 2,000

TABLE 2—HYDRAULIC-PUMP SUMMARY

	January	February	March	April	May	June	July	August
No. of wells producing	7	10	14	16	23	29	29	28
Oil production, bbl.	31,478	42,572	63,992	80,167	134,660	136,923	155,552	156,115
Fluid production, bbl.	40,576	50,255	95,411	94,167	149,260	150,851	170,103	173,399
Mechanical downtime, per cent	10.9	13.3	20.2	22.5	14.8	18.5	22.5	20.4
Average production per well per day (fluid) bbl.	187	179	220	196	209	173	189	200

to 3,000 cubic feet. The production obtained between repair jobs has varied from a few hundred barrels to as high as 40,000 bbl.

The principal objection to the use of the hydraulic—gas-lift pump is that it is difficult to install and remove from the well. It has an advantage not found in the centrifugal—gas-lift pump, in that the pump speed and, therefore, the production of the well can be controlled at the surface by regulation of the power-oil input.

Summary

For producing at low rates of flow, hydraulic and sucker-rod pumping are in direct competition with one another. At high rates of flow the centrifugal pump is outstanding. In general, there is little actual difference in the three pumping methods mentioned as to cost per barrel produced. Some operators, however, claim lower per-barrel costs with the hydraulic pump.

The advantages of sucker-rod pumping are: It is simple in principle, and the present personnel is fairly familiar with the equipment. The disadvantages are: It does not fit all types of wells, such as crooked holes; service equipment and labor requirements are large; it requires considerable replacement of material; and has the low over-all efficiency of 27 per cent.

The advantages of hydraulic pumping are: It has low cost of installation and operation; it is generally adaptable to all types of wells of moderate and small flowing capacity; its efficiency is not affected by crookedness of the holes; well conditions are easily determined by action of pressure gage at the surface; and it has the high over-all efficiency of 60 per cent. The disadvantages are: It requires trained personnel, and thoroughly-cleaned power oil; it is difficult to start in operation; and paraffin trouble is excessive.

The advantages of centrifugal pumping are: It produces at high rates of flow. Disadvantages are: It cannot be economically adapted to wells of small capacity, nor to some wells of large capacity which require handling of excessive quantities of sand or free gas; it does not deplete the sand as well as other methods; it has the low over-all efficiency of 36 per cent; furthermore, high-speed equipment is usually short-lived.

OIL-WELL PERFORMANCE

(Continued from Page 113)

Potential Estimations

The term "potential" has been construed to embrace a number of definitions. From a standpoint of well performance, it is proposed to limit and quality "potential" as follows:

1. *"Absolute potential," defined as the rate of production which will exist when the pressure at the bottom of the producing interval open to a well has been reduced to 0 lb. per sq. in., absolute.* This term is symbolized: $Pot._A$. Absolute potential can be estimated by the extrapolation of a suitable draw-down curve to zero pressure, absolute, at the bottom of the producing interval. In cases where the draw-down curve is linear, $Pot._A$ may be calculated from an equation, in particular:

$$Pot._A = I\ (P_d + 15) \quad \ldots\ldots\ldots\ldots (32)$$

where: P_d = static pressure at the bottom of the producing interval.

Other units as previously described may be used.

It is realized that absolute zero never can be attained at the bottom of an oil well, but to include vacuum pumping conditions such a definition is requisite.

The absolute potential of a well can be approached closely under pumping conditions only. During the flush period of a well, this term may be applied to proration studies, potential-time declines, etc.

2. *"Datum potential," defined as the rate of production, which will exist when the pressure at a specified datum is reduced to a known practical minimum.* This term is symbolized as:

$$Pot._{d,p} \quad \ldots\ldots\ldots\ldots\ldots\ldots (33)$$

where: d = datum in feet of depth.
p = minimum practical producing pressure at *d*.

Datum potential may be determined from draw-down curves, or calculated from productivity indices. For comparative purposes, standardization of datum points and minimum producing pressures is necessary. In explanation: *a.* The datum potential of a flowing or gas-lift well will be that rate of production which exists when a well is producing against minimum trap pressure, or minimum gathering-system pressure. The practical minimum sub-surface pressure will then be the sum of the well-head back pressure plus the pressure drop from the datum to the surface. *b.* The datum potential of a pumping well will be that rate of production which exists when the casing pressure is at a minimum value and the producing fluid level is at the pump intake.

Effectiveness of Pumping Wells

Often it is desirable to express the ratio between actual and maximum production rates. *"Effectiveness,"* the term selected for this ratio, is to be distinguished from efficiency, a term connoting mechanical considerations.

Installation Effectiveness

"Installation effectiveness" is defined as the ratio of actual production rate to datum potential. The datum will be the depth of the pump intake.

Installation effectiveness, $E_I = R_e/Pot._d \quad \ldots (34)$

Absolute Effectiveness

"Absolute effectiveness" is defined as the ratio of actual production rate to absolute potential.

Absolute effectiveness, $E_A = R_e/Pot._A \quad \ldots (35)$

Often the term *"absolute effectiveness"* may be used to evaluate other methods of production. The selection of the optimum time to gas-lift or pump is facilitated when the absolute effectiveness of different production methods is known.

Conclusion

As the study of well performance has developed, general terms of indefinite meaning have been evolved. This paper has limited these terms by introducing specific definitions. To describe adequately the general subject of oil-well performance, new terms have been included. It is believed that understanding of both oral and written discussions will be facilitated if standards are adopted while the subject is still in a formative stage.

The writers wish to express their appreciation for the helpful criticism and suggestions offered by H. C. Pyle of the Union Oil Company of California, W. E. Gilbert of the Shell Oil Company, H. N. Marsh and E. V. Watts of the General Petroleum Corporation, and E. K. Parks of the Standard Oil Company of California.

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Legislation as It Affects Oil Industry

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What is most needed, in my opinion, is more interest among the oil men of the country generally in all that pertains to the relations of the industry to the public. There has been too much timidity on the part of oil men the country over in the matter of contacting their own lawmakers. Senator Barkley, the new leader in the senate, recently declared: "I do not know of any officer of the government who would not gladly receive the honest, fair opinion of any man in business." I think that oil men generally should act on this assumption and that they should not fear criticism that such a course constitutes an interference on the part of business with legislation.

Donald Richberg, who certainly cannot be regarded as a partisan of the business man in relation to government, declared in a public address about two months ago that he is convinced that "unless we can get more business intelligence into political policies, and more political intelligence into business policies, we are on the way to a struggle for power that will cost the American people more than any war or depression in our history."

That is what I am suggesting here to the oil men of the country that they take steps to get more business intelligence into political policies by putting more political intelligence into their business policies. Every executive and every employe of every unit in the oil business ought to be a public relations representative of that unit. I have said that the oil industry is preeminently a good citizen of American industrial society, and that it deserves the best of treatment at the hands of society. It will receive such treatment when the oil men of the country realize their full duty in this respect, and when they use the daily opportunities they are afforded for performing this duty.

We have been told that we have a new conception of the responsibility of government to the people of the nation. I do not think we have *that* conception as yet.

I do not find that there is a public demand for many of these new plans. The people of this country have not changed. Their views on matters fundamental are very much what they were years ago. What is happening is that something akin to an old-fashioned revival is on. The old-fashioned revival drew crowds, without respect to religious creed, and there were surprises as to sudden "professions of faith" under the stimulus of emotional appeal. But the community never wholly changed. When it was over, the same churches were there, the same people attended them with a few additions, and business went on as usual. No community, however, could survive a continuous revival and I never heard of one that thought it could.

It may be that what is happening is that our legislative plants are turning out some new products and then trying to build up a market for them. Might they not, with profit, do as the business man does? First, thoroughly survey the field, to ascertain what is needed, including quantities, qualities, types. Then carefully estimate costs, distribution, etc. Then consider effect of obsolescence and scrapped equipment. Then size up the situation and see if profits and benefits in sight warrant the change.

*Extract from paper before A.P.I., Chicago.

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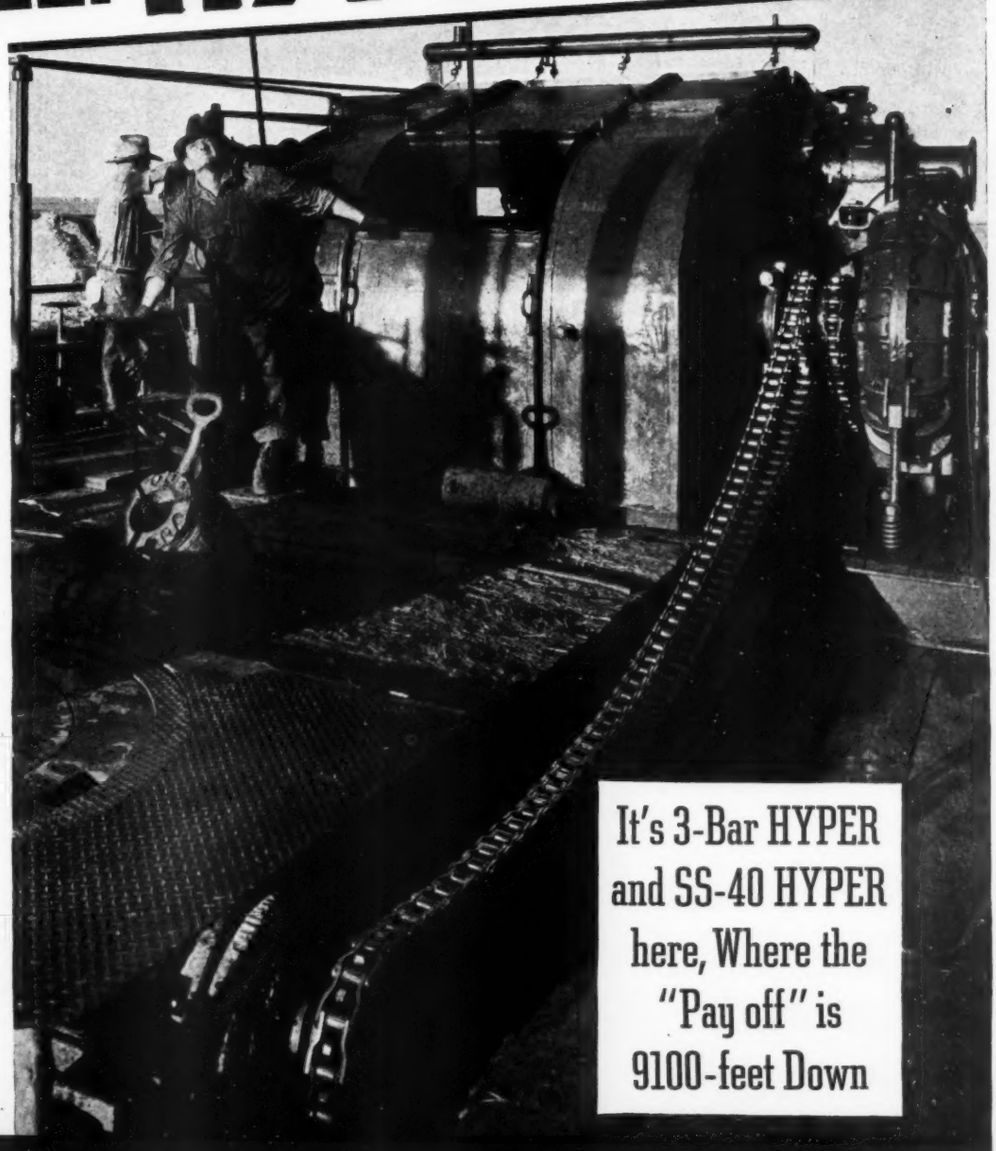

It's 3-Bar HYPER and SS-40 HYPER here, Where the "Pay off" is 9100-feet Down

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Effect of Altitude on Anti-knock Requirements of Cars

By
Neil MacCoull, K. L. Hollister and Roy C. Crone
The Texas Co., New York, N. Y.

The object of the investigation reported here was twofold:

1. To determine the effect of altitude on the octane requirements of a typical group of 1937 cars, with:
   a. The conventional straight-run series of secondary reference fuels, and
   b. A corresponding series of cracked fuels.
2. To determine the effect of altitude on the correlation between the car and laboratory anti-knock ratings on a series of cracked fuels.

Test Course Locations

The highest location in the United States at which it appeared practical to run a test car was near Fall River Pass on the Trail Ridge Road in the Rocky Mountain National Park. Here, at a section of improved highway about 20 miles from Estes Park, a fairly level section*, about one-half mile long was found at an elevation of 12,100 feet. Since this location was only a few hours' drive from Denver where many level highways are available at about 5,100 feet altitude, it was possible to obtain additional data at an intermediate altitude before the test cars had run enough to change their condition appreciably.

Sea level data had been obtained about a month earlier at a location near Sacramento, Calif. Since it had been unavoidably necessary for the test cars to cover considerable mileage and time between the tests at Sacramento and Fall River Pass, another set of intermediate altitude runs was made during the two days following the Sacramento runs, at Hampshire Rocks, which is between Emigrant Gap and Donner Pass on Route 40. Here there was an excellent location at an altitude of 6,000 feet, on an improved highway which was quite level for over a mile in length.

There were thus, in this investigation, two pairs of test runs made about one month apart; the first pair at sea level and at 6,000 feet, and the second pair at 5,100 feet and 12,100 feet. The two intermediate altitude tests gave an opportunity to determine if the test cars had changed appreciably in their fuel requirements during the month that had elapsed between the low- and high-altitude tests.

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

Cars Used

Twelve 1937 cars were used in these tests. They represented over 90 per cent of all 1937 cars sold in the United States, and may be considered typical of modern cars which are kept in good condition.

These cars had covered about 14,000 miles at the time of the first pair of tests, and 20,000 miles at the time of the second pair of tests. They had been serviced periodically by dealers handling each make of car. Despite this fact, checks made on the spark advance† of most of the cars after the tests at Hampshire Rocks and at Denver revealed that several did not have the spark setting recommended by their manufacturers.

TABLE 1—CARS USED

Cars	Per cent of total 1937 new registrations*
Ford 85	22.8
Chevrolet "Master 6"	21.8
Plymouth	13.8
Dodge	7.3
Pontiac Eight	5.8
Oldsmobile Six	5.1
Buick 40	5.6
Packard 120	2.8
Chrysler Royal (C-16)	2.3
Terraplane	2.2
Studebaker President	2.1
Lincoln Zephyr	0.7
Total	92.3

*Automotive Industries, 77 (6) 170 (1937).

No change was made in the spark settings found, since they were assumed to approximate what might be typical of any car of the same make as adjusted by the dealers in the territory through which it was serviced. The fact that the average car requirement at sea level was only one octane unit lower than the limit of "Q" gasoline indicates that the dealers probably set the spark to give good performance on the gasoline available, in spite of the unavoidable engine changes which result from car use, such as carbon accumulation in the combustion chamber and lime deposits in the water jackets.

Test Fuels

A series of test fuels was made up by blending the standard A.S.T.M.-C.F.R. secondary reference fuels A-5 and C-10 in steps differing by 3 to 5 octane numbers. When ratings were required lower than the value of the A-5 fuel (40 octane), blends were made of A-5 with the M-1 (21 octane) fuel used by the C.F.R. Aviation Fuel Committee; and, when still lower values were required nheptane was blended with the M-1. When higher values than C-10 were required, blends were made with F-1. This entire series is thus seen to be composed of "straight-run" fuels or their equivalent. The A.S.T.M. method was used in the determination of all octane numbers.

A second series of fuels was included in the runs at Sacramento and Hampshire Rocks, which simulated cracked commercial fuels. A stabilized cracked gasoline of 71 octane was blended with M-1 for lower octane values, and additions of ethyl fluid were made for higher octane values. The use of M-1 in these blends was decided on because the very low octane value of this fuel provided blends having the largest practical content of the cracked base gasoline. Even so, the blends of lower octane number contained so little cracked stock that it was decided to drop them in the high-altitude test and the companion test at Denver. Table 2 shows the "sensitivity" of each of the cracked series of fuels, as indicated by the difference between the C.F.R. research and A.S.T.M. anti-knock ratings. It is assumed that the straightrun series of C-10 and A-5 blends will be given the same values by both the C.F.R. research and the A.S.T.M. methods and, therefore, have a zero "sensitivity."

TABLE 2

A.S.T.M. Octane Number	Per cent of cracked stock in blend	"Sensitivity" cracked series
25	5.5	0
30	12.0	0
35	19.5	0
40	27.0	0
45	35	0
50	44	0
55	55	0
58	62	1.5
61	69	2.5
64	76	4
67	85	5
70	94	7
71	100	8
73	100*	8.1
76	100*	8.5
79	100*	9

*Ethyl-fluid additions of 0.20, 0.65, and 1.38 cc. per gallon, respectively.

Obtaining the octane requirement of each car on each of these two series of fuels was equivalent to rating individual samples of the cracked series in terms of the straight-run series as is done in rating the fuels in the laboratory on a standard A.S.T.M.-C.F.R. engine, except at lower knock intensity. When a car requirement was not the same on both series of fuels, it was said to "depreciate" the cracked fuel if the requirement with the cracked fuel was higher than with the straight-run series. When a car rating with the cracked series was lower than with the straight-run series, the car was said to "appreciate" the fuel. This is in agreement with the colloquial terminology of the

TABLE 3

	Straight run series								Cracked series			
Altitude: Location:	Sea level Sacramento		5,100 ft. Denver		6,000 ft. Hampshire Rocks		12,100 ft. Fall River Pass		Sea level		6,000 ft.	
Date:	July 1937		Aug. 1937		July 1937		Aug. 1937		July 1937		July 1937	
Car No.	18	19	23	24	21	22	20	21	18	19	21	22
1	79	77	66	63	62	60	26	33	73	71	59	60
2	75	79	63	67	65	64	44	44	73	76	65	65
3	73	75	57	56	53	52	26	29	70	73	58	55
4	71	67	52	55	54	49	29	24	66	67	54	47
5	61	61	44	36 (39)	40	39	—0	—0	61	60	41	42
6	61	61	57	61 (40)	38	35	25	29	61	60	40	35
7	74		62	61	62	63	34	38	71		62	61
8	68	69	53	51 (59)	52	40	0	0	69	67	54	44
9	66	66	59	55 (59)	53	55	28	25	67	66 (63)	53	55
10	64	61 (67)	42	46	35	37	0	0	66	61 (63)	36	37
11	69	63	39	40 (52)	43	39	0	0	69	64	43	44
12	66	64	49	53 (52)	40	43	15	15	68	65	41	43
Average car requirement	68.9	67.5	53.6	55.4	49.7	48.0	19	19.7	68.0	66.9	50.5	49.0

*As required by A.P.I. procedure for determinations of car anti-knock requirements.
†The device used for such checks was a typical commercial neon-light spark indicator. Three cars were not tested, because the device used could not be attached conveniently in the field.

industry at present, although the terms are awkward and might be improved when nomenclature is standardized for this phenomenon.

The correlation between the cracked and straight-run gasoline series in these cars and laboratory ratings on these fuels is discussed later in this paper.

Test Methods

The cars were divided into two groups, each of which was tested by one of two trained knock observers on a single day. The second day, at the same location, the knock observers exchanged groups so that each car was rated independently by two observers on successive days at each location. The average of these two readings was taken as the final rating.

The test procedure, while following A.P.I. procedure for rating cars, included some additional details. It consisted of short accelerations, from 10 to 50 m.p.h., on a comparatively level road with the various test fuels, recording the maximum knock intensity, the car speed at which it occurred, and the car speed at which the knock disappeared. Two sets of curves, such as given in Figure 1, were plotted from these data: 1, car speed at which the knock disappeared, against laboratory ratings of the test fuel used; and, 2, apparent knock intensity of maximum knock from each test fuel, plotted against its laboratory rating. Since fuels of three different octane ratings in each series were usually run, it was possible to extrapolate the latter curves to the octane rating which would give no knock. The former curve gave a check value, by determining the point at which the line representing the car speed for no knock coincided with the line representing the car speed for maximum knock. Further details of the test procedure are given in the appendix.

TABLE 5—STRAIGHT-RUN SERIES

Car No.	Sea level	5,100 ft.	6,000 ft.	12,100 ft.	Differences: Sea level 6,000 ft.	Differences: 5,100 ft. 12,100 ft.	Differences: 5,100 ft. 6,000 ft.
1	78	65	61	30	17	35	4
2	77	65	64 5	44	12 5	21	0 5
3	74	57	52 5	28	21 5	29	4 5
4	69	54	52	27	17	27	2
5	61	40	39 5	0	21 5	40+	0 5
6	60	59 (`9)*	36 5	27 (7)*	23 5	32	23 5 (3)*
7	74	62	62 5	36	11 5	26	—0 5
8	68 5	52	46	0	22 5	52+	6
9	66	58	54	27	12	29	4
10	62 5	44	36	0	26 5	44+	8
11	66 5	40	41	0	25 5	40+	—1 0
12	65	51	41 5	15	24 5	36	—4 5
Average	69	52	49	18	19 6	34 2	3

*Corrected value—See (†).

Comments

1. While almost all cars showed a tendency for the knock to die out as the speed was increased, there were four cars which showed an opposite characteristic. Cars No. 5, 6, 11, and 12 all showed a characteristic of increased knock intensity with car speed.

2. The weather conditon was very uniform during this series of tests, the temperature varying from about 82 to 89° F. at all locations, except at Fall River Pass where it varied from 50 to 65° F. This lower temperature seems to be the normal effect of the high altitude, since on the same days the temperature at Denver was in the 85-90° F. range. The weather was perfectly clear during these tests, with the humidity ranging from about 30 to 40 per cent.

Results

Table 3 shows the individual data secured each day. Since the date on each of two consecutive days were obtained by different knock observers, it will be seen that they checked each other, in most cases, within a very few octane numbers. In those instances where they disagreed excessively on separate days, they were able to agree with each other when making a third run. It is our belief that, in most cases, the difference found was probably a real difference resulting from mechanical changes such as could be produced by backlash or friction in the centrifugal or vacuum spark-advance mechanisms.

An evaluation of the consistency of the check readings is given by the mean deviation of the data at each location: viz., the average of the differences between the two values for each car, regardless of sign, as shown in Table 4:

TABLE 4—MEAN DEVIATIONS (OCTANE NUMBERS)

Altitude:	Sea level	5,100 ft.	6,000 ft.	12,100 ft.
Straight-run series	2.2	2.7	3.1	3.1
Cracked series	1.8	..	2.8	..

The increased deviations with altitude reflect the increased difficulties of operation at the higher locations. It is interesting to observe also that the mean deviations were less for the cracked series than for the straight-run series.

In Table 5 are shown the average data at each altitude. It will be seen that the average for all cars varied from 69 at sea level, to 52 at 5,100 feet, to 49 at 6,000 feet, and to 18 at 12,100 feet. There were four cars which failed to knock at 12,100 feet with unblended nheptane, presumably zero octane, and their requirements were accordingly rated as minus zero.

It was expected that the cars might have changed in those adjustments affecting their antiknock requirements during the 5,000 to 6,000 miles run between the two pairs of tests. As mentioned previously, the reason for the Denver test at 5,100 feet was to obtain a rough check on the values obtained earlier at 6,000 feet. As will be shown later, the effect of altitude at 5,000 feet to 6,000 feet is to change the octane requirement about 3.5 units. Thus, for the 900-foot difference in altitude the octane requirements for the cars at Denver should have been about 3.0 octane higher than at Hampshire Rocks. Table 6 shows the actual differences found which, with the exception of cars 6 and 10, might be considered in as good agreement with the estimated differences as could be expected when it is recalled that the cars had been driven some 6,000 miles between the tests at these two altitudes.

†Even car 10 may be in line, because it showed

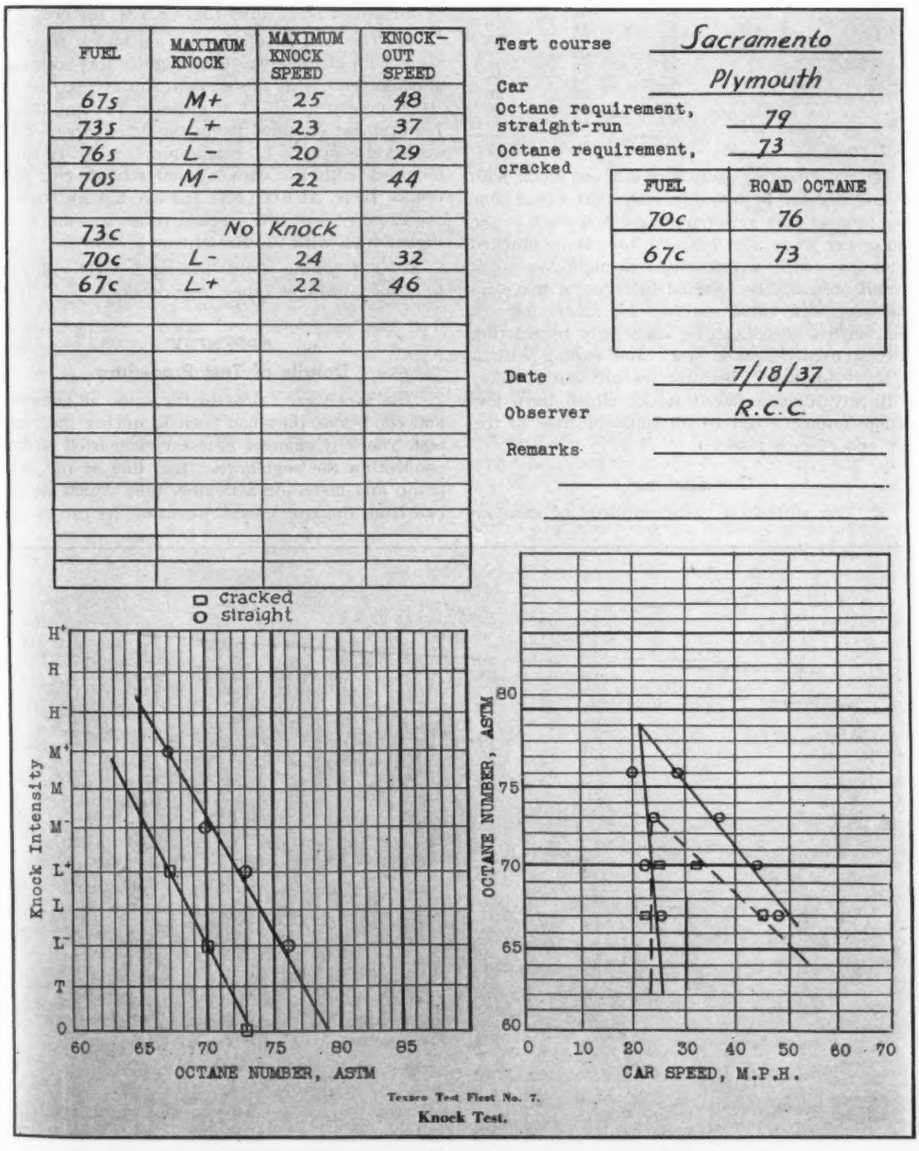


Fig. 1—Typical modified A.P.I. test method data

the greatest sensitivity to altitude of any car in each of the two altitude steps from 0 feet to 6,000 feet and from 5,100 feet to 12,000 feet, as may be seen in Table 5.

TABLE 6

Car No.	Difference between car requirement at 5,100 ft. and 6,000 ft. (Octane No.)
1	4 0
2	0 5
3	4 5
4	2 0
5	0 5
6	23 5
7	—0 5
8	6 0
9	4 0
10	8 0
11	—1 0
12	4 5
Average (car 6 omitted)	3

Since the sensitivity of car 6 to each of the two altitude steps was very close to the average for all cars, it is obvious that some vital change in conditions had occurred between the two altitude steps. It was, therefore, considered justifiable to correct for this change by deducting 20 from the octane requirements of this car for both the 5,100- and 12,100-foot altitude tests. With these corrections in Table 5, the average of all cars at each altitude has been plotted in Figure 2, which shows a very consistent curve. The dotted curves give the maximum and minimum values recorded at each altitude. Another curve, taken from tangents to this curve, indicates the rate of change of octane requirement at any elevation up to 12,100 feet.

Mixture Ratio

The lowered octane requirement at high altitudes is, of course, due primarily to the smaller weight of air drawn into the cylinders, and is similar to closing the throttle of the engine. This loss of volumetric efficiency would probably be fairly uniform for all cars at a given altitude; and it seems that, in addition to the characteristics of the individual carburetors, a reason for the differences in octane requirement shown by various cars may be the initial setting of the carburetors. With the mixture ratio set for optimum power at sea level, a car would obviously lose less power and drop less in its antiknock requirement from the super-rich mixture at high altitude than if a car had been set with a rich mixture at sea level.

In order to learn how much difference in car performance would result in using leaner carburetor jets at high altitude, three cars were run at 12,100-foot altitude, with jets provided by the Denver dealers of the individual cars for 10,000-foot operation. In each case the car acceleration was improved, as will be seen below. The octane requirement increased also.

Car No.	Improved acceleration (per cent)	Increased antiknock requirement (octane No.)
2	8.5	3
4	18.0	8
8	6.5	?

The change in antiknock requirement of car 8 due to the use of the leaner jet was obviously indeterminate, because even with the leaner jet it did not knock on the nheptane.

Correlation of the Cracked-Fuel Series

The cracked series of fuels was matched against the straight-run series during the first pair of tests, viz., sea level and 6,000 feet. They were not included in the pair of high-altitude tests, because the low antiknock requirements necessitated blends containing so little cracked stock that their performance was expected to be almost identical with the straight-run series.

The cars are arranged in Table 5 according to their tendency to "appreciate" the cracked series of fuels. Car 1 shows a 72-octane cracked stock to be as good as a 78-octane straight-run stock (Tables 6 and 7). In other words, it "appreciates" the cracked stock 6 octane units. At the bottom of the list car 12 "depreciates" the cracked stock by 2.5 octane units. It will be seen that these cars are arranged very roughly in the order of their actual antiknock requirements. This would be expected because the cracked series contains a larger proportion of straight-run gasoline as the antiknock values of this series are decreased. Thus, the 65-

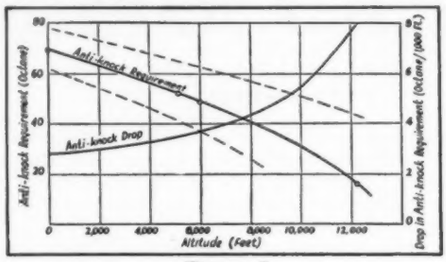


Figure 2

octane blend required by car 12 contained a smaller percentage of cracked gasoline than the 78-octane blend required by car 1.

TABLE 7—CRACKED SERIES

Car No.	Sea level	6,000 ft.	Difference
1	72	60	12
2	75	65	10
3	72	57	15
4	67	51	16
5	61	42	19
6	61	38	23
7	71	62	9
8	68	49	19
9	67	54	13
10	63	37	26
11	67	44	23
12	67	42	25
Average	67.5	50.0	17.5

This decreasing content of cracked stock with octane number is probably just what would happen in a refinery supplying a cracked stock to the motor car trade, for it would have some cracked stock to which a low-octane straight-run stock would normally be blended in order to make up the antiknock value required for marketing. In fact, such a series can be made only by starting with a highly-cracked stock and ending with a straight-run stock, because we are not familiar with any highly-cracked stocks which have low octane numbers and which could be used at the low end of such a series.

Conclusions

1. The antiknock value required of gasoline by automobiles in order to suppress knock decreases with increasing altitude. For average cars, the rate of decrease varies from about 3 octane units per 1,000-foot elevation from sea level, to about 7.5 units at 12,000 feet.

2. Over the large area of the western plains, where the altitude is over 4,000 feet, average cars can use gasolines of at least 10 octane units lower value than at sea level. None of the cars tested required over 63 octane at this altitude, although some required up to 78 at sea level. As illustrated in Figure 3, there are at least seven states which are several hundred miles from an altitude less than 2,000 feet, where a gasoline can be used of about 5 octane units lower value than at sea level.

3. The mixture ratio supplied by the carburetors of average cars becomes excessively rich at high altitudes. Use of smaller carburetor jets noticeably improves the acceleration of cars under these conditions. They also increase the antiknock requirement of the car a few units but, even so, the requirement is far below the antiknock value of commercial gasolines.

4. The "appreciation" of the cracked series varied from 6 octane units to a "depreciation" of 1.5 units—in other words, one car gave 6 octane units higher rating to the cracked gasoline than its A.S.T.M. rating, and another car gave 1.5 units lower rating to a gasoline containing about 80 per cent of a cracked stock than the A.S.T.M. method.

5. The rate of change of antiknock requirement with altitude was only slightly less with the cracked than with the straight-run series, due to the depreciating effect of altitude. The antiknock requirement obtained using the cracked series at sea level averaged 1.5 octane numbers lower than obtained with the conventional straight-run reference fuels. At 6,000 feet the average antiknock requirement with the cracked series was one unit higher than with the straightrun series.

6. The results of this test agree well with unpublished work of other organizations.

APPENDIX

Details of Test Procedure

The cars were tested in the same adjustment and conditions they had been in during the road test. The only changes necessary consisted of disconnecting the regular car fuel line at the fuel pump and installing a flexible tube which would run from the rear compartment of the car to the

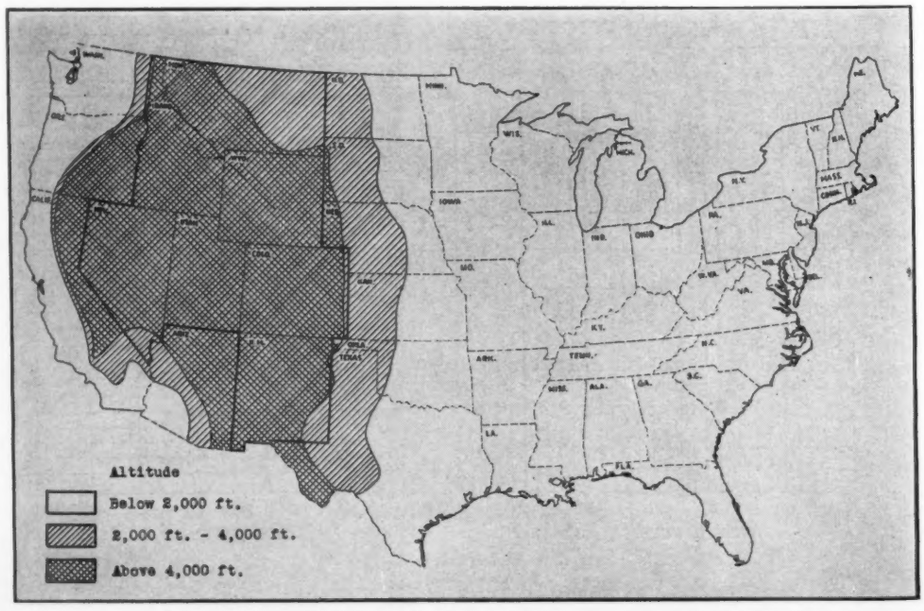


Fig. 3—Map showing altitude of western part of the United States

fuel pump. In order to expedite the test at Sacramento, two cars had fuel lines thus changed over the night before the first test and were driven to the test course drawing commercial motor gasoline from a 5-gallon can in front of the rear seat of the car. These two cars were then ready for test as soon as they arrived at the test course, and the remaining cars to be tested had their fuel lines changed over in the same order as they were to be tested.

Five gallons each of the various blends in the two series of test fuels were prepared in advance, there being twelve 5-gallon standard "racing fuel pails"‡ available for each series of fuels. In order to avoid confusion between the two series of fuels, the pails containing the straightrun fuels were marked in red paint with the A.S.T.M. octane numbers of the blends which they contained; and the cracked series was marked with octane numbers in green paint. Throughout the test work the containers of these two series of fuels were kept at one end of the course in two separate rows.

As soon as any car was prepared for test (by changing over to the flexible fuel lead) it was taken out on the road and run for several miles while drawing commercial motor gasoline from the 5-gallon can carried in the rear compartment of the car. After a pair of cars was warmed up, they were taken over by the antiknock observers who started out with any pail of the test gasoline which they desired to try first. When a pail of test fuel was put into the car, the can of commercial gasoline was removed and the engine was kept running on the fuel remaining in the fuel system. There was enough fuel to have the car started on the test course; and, as soon as the engine ceased firing on account of having used all available fuel, the flexible fuel line was inserted into the pail of test gasoline. Usually the inertia of the car would continue to spin the engine until it started on the test fuel.

The car was then driven along the road for at least one-quarter of a mile, was slowed down to 10 m.p.h., and accelerated to a speed of 40 to 50 m.p.h. by suddenly opening the throttle wide. Since the test course was approximately 1 mile long at each location (except at Fall River Pass) and had suitable points for the cars to turn around at each end, it was possible to have three or four acceleration readings along one trip of the course. These accelerations made it possible for knock observers to record the knock characteristics of a fuel in a car, and usually one round-trip of the car was all that was necessary on one fuel.

TABLE 8—BLENDING PROPORTIONS FOR ROAD TEST FUELS

"C" SERIES

A.S.T.M. octane No.	Per cent mixture		4,000-cc. mixture	
	M-1	Cracked fuel	M-1	Cracked fuel
25	94 5	5 5	3,780	220
30	88	12	3,520	480
35	80 5	19 5	3,220	780
40	73	27	2,920	1,080
45	65	35	2,600	1,400
50	56	44	2,240	1,760
55	45	55	1,800	2,200
58	38	62	1,520	2,480
61	31	69	1,240	2,760
64	24	76	960	3,040
67	15	85	600	3,400
70	6	94	240	3,760

As the car approached the end of the test course (where all the fuels were maintained) the test driver called to the man in charge of the test fuels what the next fuel would be. The car was then turned around, and the man in charge of the fuels removed the fuel pail from the car and replaced it with the desired fuel. After a little experience it was possible for the car observer, who was sitting in the rear seat, to withdraw the line from the test fuel when the car was still far enough from the end of the course so that, after changing fuels, a very short time would be necessary to consume all the fuel remaining in the fuel lines and thus start promptly on the new fuel. In order to avoid confusion, it was customary for one of the knock observers to start on the straightrun series of fuels and for the other observer to start on the cracked series. On an average about 50 minutes were required to rate each car on both fuel series.

‡Round heavy-gauge containers with special rubber-gasket seals.

As the fuel supply in the 5-gallon pails became depleted, it was replenished by a man assigned exclusively to this duty. At the site where the fuels were stored, a stake truck equipped with drums of each of the four fuels required to make up the two series was located. By means of Tables 8 and 9 it was a simple matter to draw the required qauntities of each base stock to make up 4,000-cc. lots of fuel at a time. To make sure of no error in these blends, it was a practice to write down on a pad both the desired octane number of any blend and the proportion of the two constituents involved. Each constituent was then drawn into separate glass graduates and blended together in a 4,000-cc. graduated glass-stoppered cylinder. If there were any errors in these two measurements, this error would become evident after blending because there would not have been 4,000 cc. in the mixture.

TABLE 9—BLENDING PROPORTIONS FOR ROAD TEST FUELS

"S" SERIES

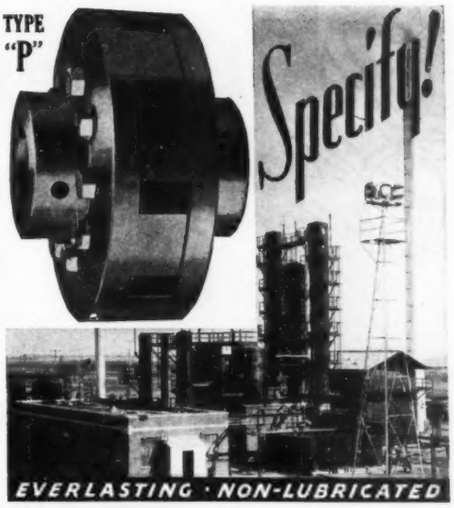
A.S.T.M. octane No.	Per cent mixture			4,000-cc. mixture		
	M-1	A-5	nHeptane	M-1	A-5	nHeptane
0	..	..	100	....	....	4,000
5	25	..	75	1,000	....	3,000
10	48	..	52	1,920	....	2,080
15	72	..	28	2,880	....	1,120
20	95	..	5	3,800	....	200
25	71 5	28 5	..	2,860	1,140	....
30	46	54	..	1,840	2,160	....
35	23	77	..	960	3,040	....
40	2	98	..	80	3,920	....
			C-10		*C-10*	
45	..	88	12	3,520	480	....
50	..	74 8	25 2	2,992	1,008	....
55	..	61 7	38 3	2,468	1,532	....
58	..	54	46	2,160	1,840	....
61	..	46	54	1,840	2,160	....
64	..	38 2	61 8	1,528	2,472	....
67	..	30 4	69 6	1,216	2,784	....
70	..	22 5	77 5	900	3,100	....
73	..	14 9	85 1	596	3,404	....
76	..	7 2	92 8	288	3,712	....

Mention should be made that the use of the "racing fuel pails" was a fortunate decision, for the usual 5-gallon square cans which were available for warming up stock, etc., proved to be unsatisfactory in some ways. In the first place, the thin flat walls of these containers vibrated badly in the cars, tending to splash the fuel out of the opening. Second, several of these cans sprung leaks due to the continued vibration and the bulging of the sides resulting from the increased vapor pressure from the sun shining on the containers when sealed, and also from the decrease in atmospheric pressure when they were transferred to high altitudes. The "racing fuel pails," on the other hand, were of a more substantial gauge metal and, being cylindrical, neither bulged from pressure nor vibrated from car motion. The outlet hole was much smaller and the rubber seal, together with the threaded plug which could be forced home by a suitable wrench, was quite an advantage in sealing these cans at night and opening them for the next morning's test.

Protection of the fuels from the sun was afforded at Sacramento and Hampshire Rocks by the shade trees; but, for the high-altitude pair of tests, shade trees were not available, and a tent was improvised for the required protection.

A.P.I. Specifications

A second edition of "A.P.I. Standards No. 11-E, Specifications for Rating of Pumping Machines, Including Rating Form for Rotary Counterbalances," has been published by the American Institute's Division of Production. The new edition incorporates editorial changes for clarification, and the status of the specifications has been changed from tentative to final.



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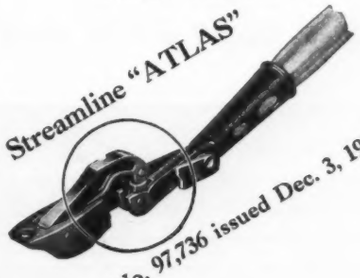

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The Catalytic Polymerization of Butylenes by Sulfuric Acid

By S. H. McALLISTER
Shell Development Co., Emeryville, Calif.

Continued improvements in automobile and airplane engines have called for "tailored fuels" of very high antiknock rating. The major source for such fuels lies in the polymerization of the lower olefins, and today there are a number of different types of commercial poly-

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

merization units in operation. The potential production of polymer gasoline has been estimated as over a billion gallons per year; and the advantages, both from an economic and conservational standpoint, have already been pointed out by Dunstan,[1] Egloff,[2] and Ipatieff,[3] and others.

The broad field of polymerization and the relative advantages of the various methods will not be reviewed here. This discussion is confined to processes for the production of an octane fuel having an octane rating of 98 to 100 from the C_4 fraction obtained from the Dubbs process.

The Shell companies have been producing isooctane in commercial quantities by two methods

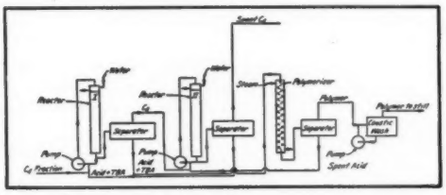


Fig. 1—Cold-acid isooctane plant

which have been developed by them. The feed stocks used vary at different refineries, but a C_4 fraction containing 18.5 per cent isobutylene and 28 per cent normal butylenes might be chosen as representative of that available at a California refinery. The first commercial process used in the spring of 1934 was a cold-acid process.

Cold Sulfuric-Acid Process

The processing unit (Figure 1) consists of two sections: an absorption section and a polymerization section. The liquid hydrocarbon is contacted with 60 to 70 per cent sulfuric acid at 20° to 35° C. countercurrently in two stages. Under these conditions the isobutylene, which is the more reactive of the olefins, is selectively absorbed into the acid phase. The absorption is an equilibrium reaction, and the amount of isobutylene absorbed depends upon:

1. *Acid strength:* The stronger the acid, the more complete is the absorption of the isobutylene below limits where polymerization occurs. However, if the absorption is to be selective for isobutylene, acids of less than 70 per cent strength should be used or the normal butylenes will also be absorbed.

2. *Acid-to-alcohol ratio in the acid phase:* The higher this ratio, the more complete the absorption.

3. *Temperature:* The lower the temperature, the more complete the reaction. However, temperatures above 20° and below 40° C. are preferable if a high reaction rate is to be obtained without premature polymerization.

Under the proper operating conditions it is possible to absorb up to 90 per cent of the isobutylene without appreciably absorbing the normal butylenes.

The acid phase, after it has reached the desired degree of saturation with isobutylene, is separated off from the hydrocarbon phase and passed through a separate polymerization unit consisting of coils heated to 100° C. The reaction is complete in about a minute, and the products are stratified—the acid being returned to the absorption unit, while the polymer is washed and distilled. With 65 per cent acid the polymer averages about 75 per cent diisobutylene, the rest being trimers. With weaker acids a higher dimer content is obtained. After mild hydrogenation of the diisobutylene cut, isooctane (2,2,4-trimethyl pentane) is obtained.

This cold-acid two-stage process has been in use for some time, and is still the most suitable method of preparing pure isooctane. However, on the basis of the total olefins present in the C_4 fraction, the yield of octane is relatively low; not more than 67 per cent of the isobutylene is converted to isooctane; i.e., less than 26.7 per cent of the total olefins in a feed stock containing 46.5 per cent olefins. Increasing demands for polymer of 98 to 100 octane number has led to the development of the present hot-acid process, in which almost twice the yield of octanes may be obtained from the same feed stock.

TABLE 1—COMPARATIVE EFFICIENCY, COLD-ACID AND HOT-ACID OPERATION

	Cold acid 65 per cent 30-35° C.	I 65 per cent acid 80° C.	II 65 per cent acid 90° C.
Fuel composition:			
Isobutylene, per cent by weight	18.5	18.5	9.1
nButylene, per cent by weight	28.0	28.0	20.6
Butanes, per cent by weight	53.5	53.5	70.3
Products:			
Isobutylene, per cent	2.4	0	0
nButylenes, per cent	26.6	15.1	11.4
Butanes, per cent	53.5	53.5	70.3
Polymer, per cent	17.5	31.4	18.3
Isobutylenes polymerized, per cent	87	100	100
nButylenes polymerized, per cent	5	46.0	44.5
Total olefins polymerized, per cent	37.5	67.5	61.5
Composition of polymer:			
Sulfur (A.S.T.M.), per cent	0.01	*0.03	*0.062
Octenes, per cent	75	88	92
Octane rating of hydrogenated octenes	100	99.2	98.8

*Negligible sulfate esters present.

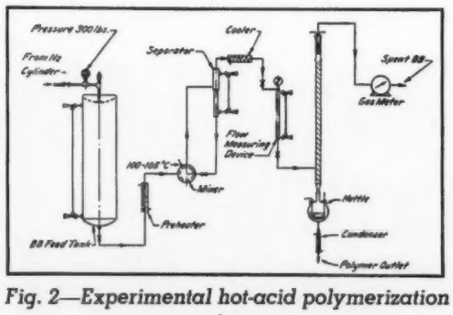


Fig. 2—Experimental hot-acid polymerization plant

Hot-Acid Polymerization

The hot-acid polymerization process was a direct outgrowth of the former process. When the temperature of the acid absorption reaction is raised, the absorbed isobutylene present in the acid phase condenses to polymer, and this is re-

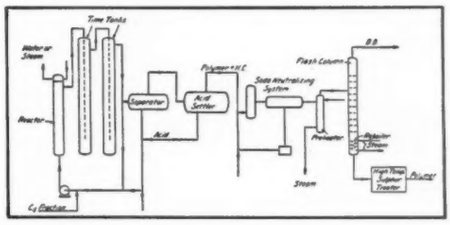
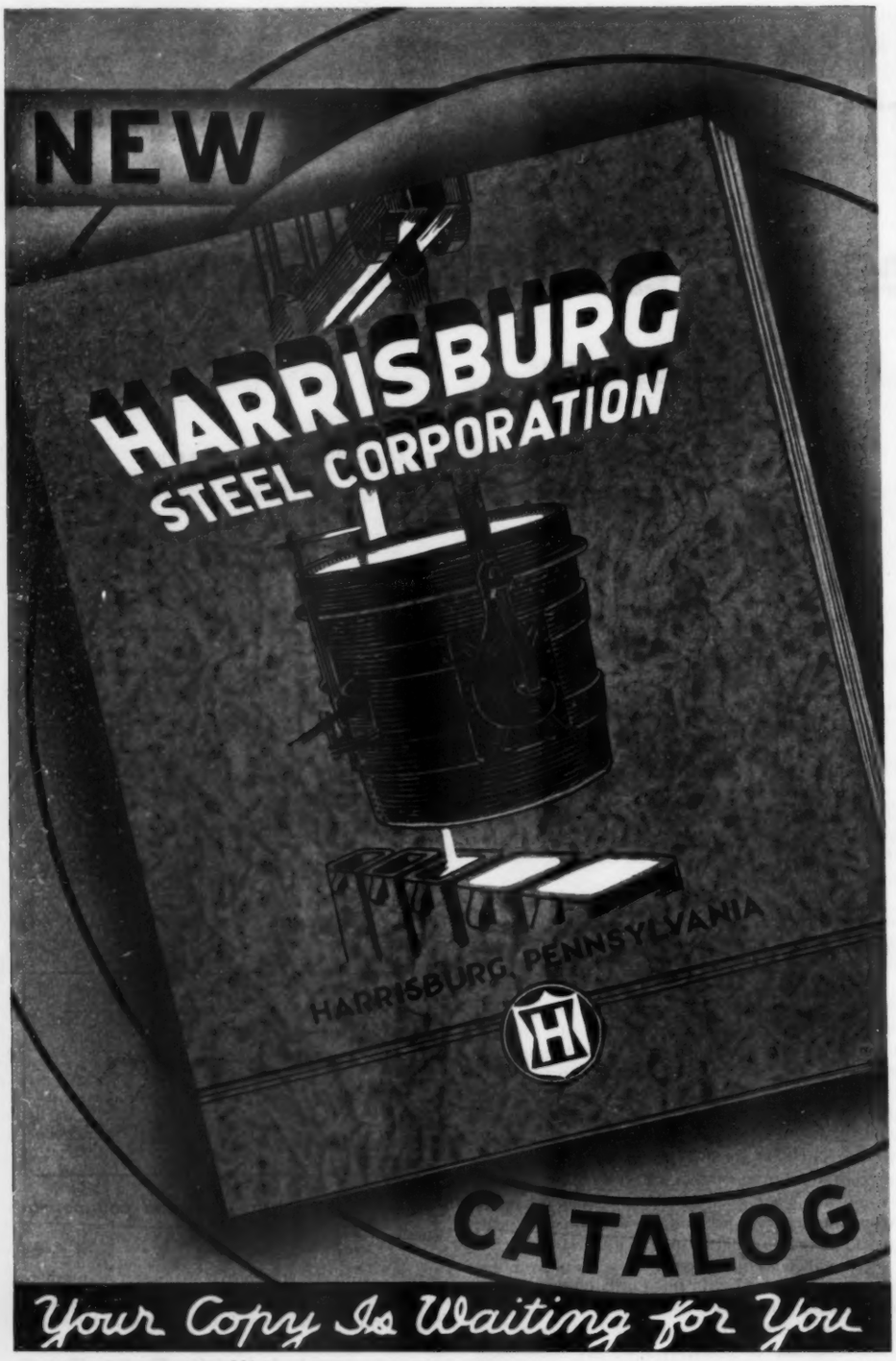


Fig. 3—Flow diagram, hot-acid polymerization plant

absorbed into the hydrocarbon phase. At temperatures above 60° C. this polymerization is sufficiently rapid that the absorbed isobutylene has only a transitory life in the acid phase, and the process becomes truly catalytic. The net effect of this is to force the absorption reaction to completion by maintaining the acid phase in a spent state. Thus it is possible to recover all of the isobutylene as polymer.

Raising the temperature also has the effect of reacting a portion of the normal butylenes, and these are absorbed into the acid layer principally in the form of acid sulfates. While the normal butylenes do not polymerize with themselves as readily as does isobutylene, in the presence of isobutylene they will react rather rapidly to form interpolymer. Thus, under proper operating conditions, it is possible to react up to an equal quantity of normal butylenes and isobutylene and, as the interpolymer on hydrogenation has an octane number nearly equal to that of pure isooctane, nearly double the yield of polymer is obtained without seriously sacrificing octane rating.

Besides the favorable effect on the olefin absorption, hot-acid operation has a further advantage in that polymer as formed passes into the hy-



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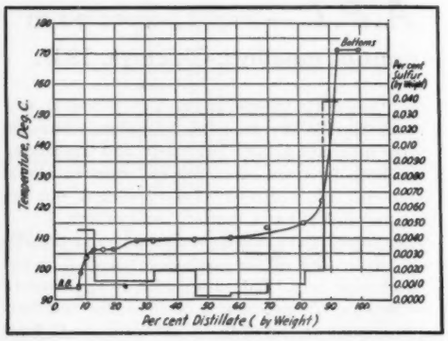
drocarbon phase, and is diluted by the inert butanes; its activity is thereby reduced, and there is less opportunity for trimer formation or rearrangement to polymers of lower octane number. The result is that the polymer is 85 to 90 per cent octenes as against 75 to 80 per cent for the old or cold absorption process. A comparison of the efficiency of the two processes is shown in Table 1. The increased yield of octenes is readily apparent.

Laboratory Investigations

The results obtained by the process are dependent upon the mechanical system used, as well as upon chemical factors, such as acid strength and temperature.

A number of experimental reaction systems has been studied. These consisted of packed towers, heated coils through which the reactants were rapidly passed, a reactor employing jet injection of the hydrocarbon into towers containing acid and a single mixer-type reactor. This latter arrangement, shown in Figure 2, proved to give the best results.

In this system the incoming feed is diluted with a much greater volume of the acid-hydrocarbon emulsion which contains practically no unreacted isobutylene. Thus the ratio of isobutylene to normal butylenes is very low, and interpolymerization



Per cent sulfur in crude, 0.031. All sulfur below 0.02 per cent analyzed by turbidity; above 0.02 per cent, by lamp titration.

Fig. 4—Martinez polymer "precision" distillation, Emeryville, Calif.

is greatly favored; whereas in the coil or tower reactors co-polymerization of the isobutylene is favored owing to its higher initial concentration and much greater reaction rate.

Using the mixer type of reactor, the effect of the several variables in the reaction was experimentally determined. It was found that:

1. The effects of temperature and acid strength are closely interrelated. Acids ranging between 63 to 72 per cent by weight can be used at temperatures from 75° to 100° C., the higher acid strength being used with the lower temperatures. It is preferable not to use stronger acids or higher temperatures, as formation of sulfur dioxide or sulfate ester will then become appreciable. Lower acid strengths lead to longer contact times and enhanced corrosion of the reactor system. However, within the above range, considerable flexibility is allowed without appreciably altering the results which are obtained.

2. The size of the acid phase also affects the reaction. The larger the acid phase, the more rapid is the reaction. However, for commercial operation in the above limitations of acid and temperature, there seems to be little advantage in using more than a 1:1 or up to 2:1 ratio of acid to hydrocarbon.

3. The effect of increasing contact time is to increase the amount of reaction until an equal quantity of isobutylene and normal butylene is reacted. Above this, large increases in contact time increase the yields only slightly.

By using combinations of these variables, it is possible to react 90 per cent of the isobutylene and 10 per cent of the normal butylene, or completely to react the isobutylene and an equal quantity of

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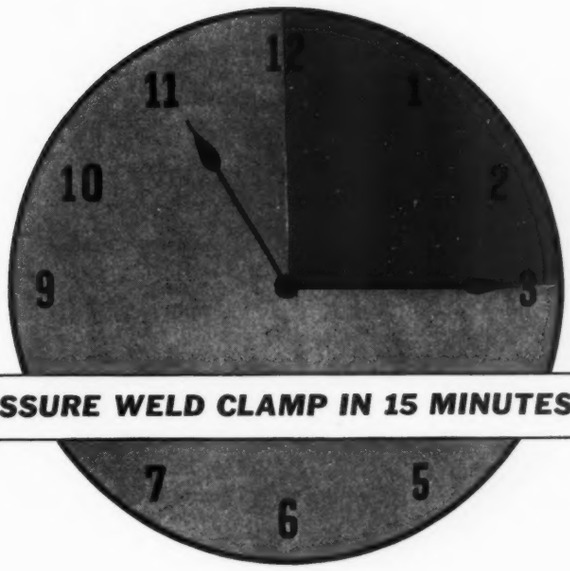

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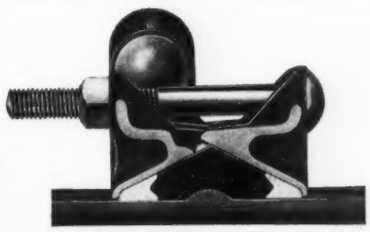

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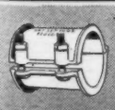
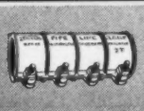
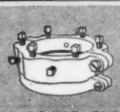


EMERGENCY PIPE CLAMP



PIPE LINE CLAMP



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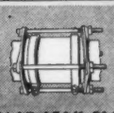
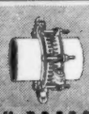
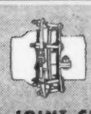


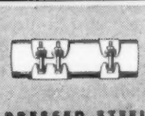
COLLAR LEAK CLAMP



HIGH PRESSURE WELD CLAMP



BELL JOINT CLAMP



PRESSED STEEL ECONOMY CLAMP

normal butylenes. This flexibility is an advantage when volatility requirements in winter call for more butanes and butylenes.

Composition of the Acid Phase

The sulfuric acid used in the process functions as a catalyst, and contains relatively small amounts of organic materials. It is used for weeks or months without change, fresh acid being added from time to time merely to make up for that lost by mechanical entrainment. The chemical consumption cost is, therefore, very low.

Large-Scale Applications

The laboratory results were directly translated to full commercial-scale plants with the predicted yields. The Martinez polymer plant is shown in Figure 3. The reactor unit resembles a single stage of the cold-acid process. In fact, the equipment is largely interchangeable. In the plant the fresh feed meets recycling emulsion, and the mixture is then rapidly recycled through a heat exchanger and time tanks. A portion of the emulsion is continuously withdrawn to a separator, where the acid is separated and returned to the reactor, while the hydrocarbon is worked up for the polymer.

The operation of the unit is extremely simple—one operator per shift being sufficient. No external heat is required, as the exothermic heat of reaction is sufficient to maintain the temperature in the reactor. The return of the acid to the reactor is largely automatic, once the rate of flow is established. In present practice 67 per cent acid is used at approximately 80° C., and a 10- to 15-minute average contact time is allowed.

Polymer Recovery System

As has already been pointed out, the polymer in the hot-acid system is recovered from the hydrocarbon layer. This recovery consists of a caustic wash to remove entrained acids or acid sulfates, a flash tower to strip off the spent hydrocarbon gases, and a high-temperature treater for further sulfur removal. This latter unit serves the valuable purpose of removing the stable sulfate esters which are present in the polymer to the extent of 0.2 to 0.4 per cent calculated, A.S.T.M. sulfur. After treatment less than 0.03 per cent sulfur remains, and sulfate-ester removal is substantially complete. The polymer is then rendered stable to distillation, or it could be added directly to gasoline without impairing its color or stability.

A distillation curve of the crude polymer obtained from the treater is shown in Figure 4. It will be seen that the entire product could be added to gasoline, and the boiling range of the octene fraction is very narrow.

The octene fraction is refractionated and hydrogenated under mild conditions. The product obtained averages 98 to 99 octane number. Thus, as already pointed out, by hot-acid operation the yield has been doubled without sacrifice of octane number.

Tables 2, 3 and 4 are set out to show a comparison between pure isooctane and hydrogenated interpolymer prepared by this process.

Corrosion: One question which is of importance in commercial applications is that of corrosion through the use of sulfuric acid at these temperatures. No special alloys are used in any of the plants. The reactors themselves are of mild steel, and the pumps are of standard design. Iron or steel tubing is used throughout. Copper and bronze could also be used, but stainless steel shows very poor service. In one refinery reactors, which had previously seen considerable service under the conditions of the cold-acid process, have been in continuous use on the hot-acid process for 18 months, and are still giving good service. With proper design and reasonable care, maintenance costs are very low. Evidence indicates that wear results as much from erosion as from corrosion, and in any case these are not serious factors when considering a plant of this type. The major cost in a polymer plant is in the distilling and auxiliary equipment, which is common to any catalytic process. The reactor unit itself is relatively inexpensive.

TABLE 2—COMPARISON OF HOT-ACID OCTANE WITH TECHNICAL ISOOCTANE

	Hot-Acid Octane	Technical Isooctane
Reid vapor pressure, lb. per sq. in.	2.3	2.1
Color, Saybolt	30+	30+
A.P.I. gravity, deg.	66.5	70.9
Olefin, per cent	1.5	1.8
Copper-dish gum, mg, per 100 cc.	1	1
Accelerated aging test, mg, per 100 cc.	1	1
Wright acid heat, deg. F.	24	23
Navy acid heat, deg. F.	3	3
A.S.T.M. distillation, deg. F.:		
Initial boiling point	208	205
Dry point	238	235
10 per cent point	222	210
20 per cent point	224	210
30 per cent point	225	210
40 per cent point	226	211
50 per cent point	226	212
60 per cent point	227	212
70 per cent point	227	212
80 per cent point	228	214
90 per cent point	229	215
95 per cent point	231	216
Distilled, per cent	99	99
Sulfur (Nephelometric), per cent	0.0001	0.0001

TABLE 3—ANTIKNOCK BLENDING OCTANE NUMBERS

Aviation Base Stock (Per Cent)	Hot-Acid Octane (Per Cent)	Technical Isooctane (Per Cent)	Octan No.
100	..	..	74.3
75	25	..	79.1
75	..	25	79.3
50	50	..	84.8
50	..	50	85.2
25	75	..	90.9
25	..	75	91.0
0	100	..	99.1
0	..	100	99.7

Note: 100 per cent hot-acid octane and 100 per cent technical isooctane were matched against one another in an engine, and hot-acid octane is found only slightly lower.

TABLE 4—LEAD SUSCEPTIBILITY—50 PER CENT OF AVIATION BASE STOCK AND 50 PER CENT OF OCTANES

Tetraethyl Lead (CC. Per Gal.)	Blend with Hot-Acid Octane	Blend with Technical Isooctane
0.0	84.8	85.2
1.0	94.6	94.6
2.0	97.0	97.1
3.0	98.7	99.1

Patents

Various features of these processes are covered by patents and pending applications in the United States and abroad.

Conclusion

From the foregoing is it apparent that the hot sulfuric-acid process as operated by the Shell companies is particularly applicable to the polymerization of the C_4 fraction when octanes of 98 to 100 octane number are desired.

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Wages in Petroleum Industry at All-Time Record High

Wages in the petroleum refining industry stood in July at 96.6 cents per hour, an all-time record high, and 50 per cent above the boom year of 1929. This compares with an average hourly wage of 65.7 cents for all other manufacturing industries in the United States.

Hours of labor in the petroleum refining industry have been reduced. The average refinery worker now puts in only 35.6 hours a week, or nearly five hours less than the average for workers in other manufacturing industries. Practical effects include the spreading out of employment and increasing the number of workers in the industry by 12 per cent.

In 1929 the average work-week in the refining industry was 49 hours and the average hourly wage was 64 cents, or approximately the rate that workers in other industries now are receiving. Despite the fact that the refinery worker's week has been reduced from 49 hours in 1929 to the current 35.6 hours, he now receives 8 per cent more weekly wages.

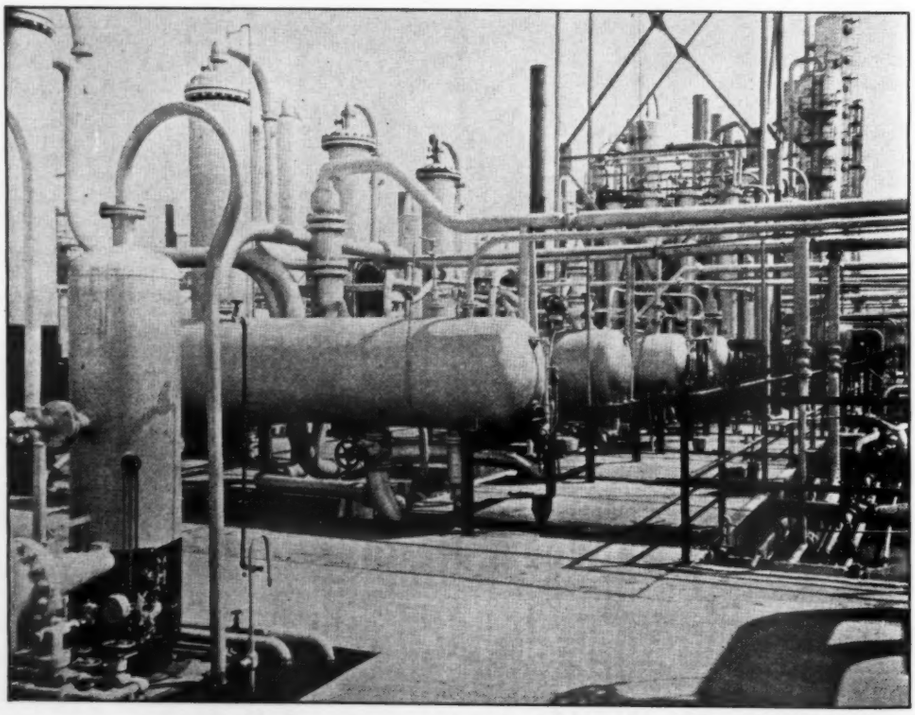


Fig. 5—Portion of polymer plant for manufacture of isooctane

Circumferential Field Welding of Casing

By L. R. HODELL
Carter Oil Co.

It seems wise to preface the discussion in this paper by saying that while the welding of oil well casing, including oil strings, is a proven success, the practice is as yet a relatively new one. For that reason, the methods and results discussed in this paper are not presented with the thought that they are the best methods or the best results to be had in the welding of casing. They are simply the methods which we have used and the results which we have obtained. It is not reasonable to think that other and better methods and results will not eventually be developed, or, for that matter, may not be even now in existence.

The Welding Problem

The first problem to be met with in welding casing is, as would be supposed, the welding problem itself. This problem is really twofold, as we have seen it. In the first place, the prime requisite to the whole process of welding casing in the hole is to have trained welders, and by trained welders we mean not only men who are good welders generally, but men who have also been trained in the welding of casing. In the second place it is desirable, even an absolute necessity, that we have pipe fabricated of readily weldable steel.

A.P.I. — Extract from paper, annual meeting, Chicago, 1937.

Dealing now with the first of these two matters, we will simply point out briefly what every employer of welders already knows. Welding has in the past too often been regarded as a general process or trade. That is to say, those not very familiar with the trade have been under the impression that a man who is a good welder at one type of work would necessarily be a good welder at another type of work, and it is only necessary to transfer him from one job to another. Actual experience, however, of those hiring welders has shown this to be fallacious. Practically all concerns which hire welders in considerable numbers do so only after the welder has successfully passed a test. It is common knowledge that many men who have welded in tank shops on pressure vessels and plates have been unable to pass the test given by pipe line contractors as a condition for their employment. It is equally true that many welders who are known to be highly satisfactory at pipe line welding have been unable to pass the tests as given by the manufacturers of pressure vessels and concerns which weld on plate. It is also well known that welders who have been highly satisfactory in either or both of these two applications of welding have been unable to pass the test requirements of aeroplane manufacturers. In fact, it would be possible to go on indefinitely in this manner, but the situation may be summed up simply by saying that each application of welding requires a definite technique, and these techniques are seldom, if ever, interchangeable. This general truth holds for the welding of casing.

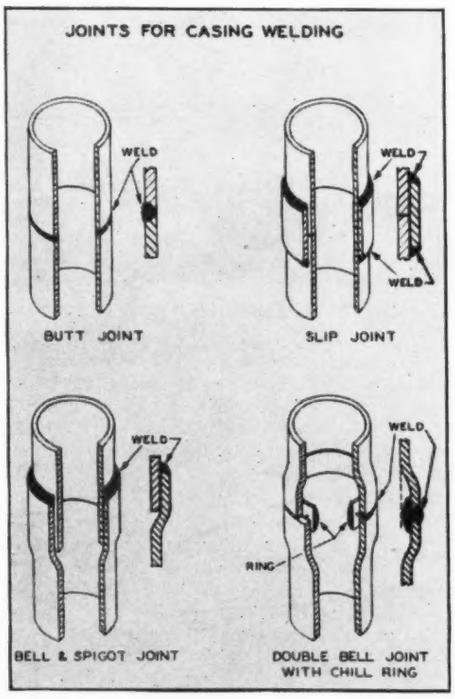


Figure 1

It should be understood that this is being pointed out to caution newcomers into the field of welding casing and definitely not to discourage anyone from getting into it. For while it is true that a definite technique is required for handling the welding of casing, it is also true that this technique can be learned in a relatively short time by practice, it being assumed, of course, that the welder or welders who are to learn are already expert in the application of some other technique.

It is our own experience that thoroughly qualified welders, properly instructed in the necessary technique of welding casing and given nipples to set one on top of the other and told to weld on them until they can hold their puddle in position will ordinarily not require more than two days practice before they are able to make a satisfactory weld.

It should be pointed out here, also, that the welding technique itself should be divided into two parts, namely that of welding bell and spigot, or sleeve type, joints, and that of welding butt joints. (Types of welded joints are to be seen in Fig. 1). The welding of bell and spigot and sleeve type joints presents little difficulty, because the weld is made in the downhand position on the shelf which results from the juncture of the coupling or the end of the lower joint with the wall of the upper joint. The butt joint, on the other hand, is a distinctly new position. Most competent welders have been trained to weld in three positions, namely, flat, overhead, and vertical. The welding of butt joint casing calls for a fourth position which, for lack of any generally accepted name, I shall call the horizontal position. The problem in this position is simply that of keeping the puddle in position. Owing to gravity, it tends to run down the side of the lower joint, and it is the problem of the welder in this position to so handle his electrode that he is able to keep the puddle in position in spite of gravity. This is probably no more difficult a position to weld in than the overhead position. It is, however, a different position, and the actual knack of handling it has to be gained by practice by the welder. The tendency, when a new man first starts the practice, is to find that he is building a rather high ridge of weld metal around the upper end of the lower joint, and is rivering around the lower end of the upper joint. As has been stated, we have found consistently that competent welders in other techniques are able to overcome this within two days or less of practice.

It should be pointed out that in this practice, and as a part of it, the welders, if welding nipples together, should be required to cut coupons from the weld and pull them. The coupons cut from butt joints will, if a sufficiently high tensile electrode is used, be able to show a weld which will cause the failure to take place in the stock of the pipe. However, in the case of coupons cut from bell and spigot joints it is usually not possible to develop the full strength of the stock of the pipe. The reason for this is obvious in that the transfer of stresses in this offset weld throws the weld at a considerable disadvantage.

In the welding of these two types of joints we

TABLE 1—RESULTS OF FULL JOINT PULLS OF WELDED JOINT CASING

	Sample number (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	7-inch 24-lb. Grade C bell and spigot	8⅝-inch 36-lb. butt joint	8⅝-inch 36-lb. slip joint	8⅝-inch 36-lb. butt joint	8⅝-inch 36-lb. slip joint	8⅝-inch 36-lb. butt joint	8⅝-inch 36-lb. slip joint	7-inch 24-lb. Grade C bell and spigot	8⅝-inch 36-lb. double bell and chill ring	8⅝-inch 36-lb. double bell and chill ring	8⅝-inch 36-lb. slip joint
Measured average thickness	.339″	.4125″	.406″	.410″	.406″	.411″	.413″	.337″	.40″	.40″	.40″
Pounds pulled when failure occurred	531,600	871,100	654,900	550,600	790,000	552,200	483,000	523,500	792,500	838,400	608,600
Stress in sample at time of failure (lb/sq. in.)	74,454	81,335	64,395	52,841	77,679	52,691	46,802	72,911	77,925	82,438	59,843
Joint efficiency	100%	100%	74.66%	100%(?)	90.06%	61.06%	55.06%	100%	100%(?)	94.12%	70.40%

Joint efficiencies based on strength of electrode, which had an ultimate tensile str ength of 85,000 pounds. This electrode was used because the manufacturer's minimum guarantee on this casing was 85,000 pounds.

have found that $\frac{1}{4}$-inch electrodes are the largest that we have been able to use successfully on butt joint pipe, and we say this after considerable effort to use larger electrodes. In the case of the bell and spigot, or sleeve type joint, we find that the only limitations as to the size of the electrodes that may be used are: (1) the capacity of the welding generator, and (2) the thickness of the wall of the bell. We can, then, use $\frac{1}{4}$-inch electrodes or even $\frac{5}{16}$-inch electrodes on a slip type joint, if the wall of the bell is at least $\frac{1}{16}$-inch or $\frac{5}{16}$-inch in thickness. Obviously, if we tried to apply a larger electrode to a $\frac{1}{16}$-inch wall the result would be that part of the electrode would extend out over the edge of the wall, and melt and run down the wall, adding nothing to the weld.

We may sum up this part of the discussion, then, by saying that welders trained in the welding of casing are necessary to the successful welding of casing. The problem of training welders, however, is not serious or too difficult, if we start with men who are already competent welders in other techniques, and can be accomplished in a very short time if care and proper supervision is given to the men in this practice.

The second part of the welding problem, namely the necessity of having a pipe of a weldable steel, might be considered by some to be really only an extension of the first part, that is to say of obtaining properly trained welders. However, while we recognize that there are two ways of looking at this thing—e.g., we can either train welders to weld pipe that is available, or we can insist on the steelmakers making available a pipe that our welders can weld—we firmly believe that the latter is the proper course.

It is our feeling that we are justified in turning this part of the problem over to the steelmakers, and we are confident they can solve it. Their problem is to furnish us with pipe which is readily weldable, and we will be a little more specific in what we mean by that, namely, a steel which has an average carbon of .25, but an absolute top rating of .35. If two steelmakers present steels which are otherwise acceptable and satisfactory for the welds, it is certain that the one presenting the steel with the lower carbon will more readily find a market for his product. The problem of the steelmaker, then, is to present us with a pipe which will have as low a carbon as possible, and in no case a higher carbon than .35, and still give us a steel which will have such collapse-resisting qualities as will make it feasible to be used in deep wells. There is at this time pipe available on the market which will meet these requirements, and there is little doubt but what other pipe will be made available whenever the steelmakers really give this their best thought.

The Floor Problem

For lack of a better way of designating it, we term the problem of acquiring the necessary equipment for the running of welded casing and the training of drilling crews in the operation the "Floor Problem."

Considering the problem under the first of these two heads, it is, of course, necessary to acquire equipment to facilitate the running of welded casing. The practice is still sufficiently young that there is not on the market complete equipment for this purpose, and it is necessary for that reason for the operator to devise certain pieces of equipment that will serve his purpose.

In the running of butt welded casing, the first problem is to pick up the single joint from the walk and bring it into the derrick. In the running of threaded and coupled casing, it, of course, has been necessary simply to put a slip noose under the coupling. This, however, is not considered safe, even when manila rope is used, in the case of plain end casing. For that reason it is necessary to devise something to take hold of the single joint of casing and pick it up, and in Fig. 2 will be seen what we call our "Pickup Clamp." It is hinged in the middle, and is tightened by means of a threaded toggle. We cut two grooves around the inner surface of this pickup clamp and filled them with babbitt, so that when the clamp is tightened up we believe we get a better friction hold on the soft babbitt than we could get on the bare steel.

After the single length of butt joint pipe has been picked up, it is necessary to align it very accurately. This we do by means of our lineup clamp, which is seen in this same Figure.

We find that it is well worthwhile to supply our crews with electric hammers, which are driven by auxiliary generators on our welding generators. These hammers are powered by a 110-volt circuit.

In the handling of bell and spigot or slip joint casing, it is not feasible to line up the casing by means of our particular type of lineup clamp, so

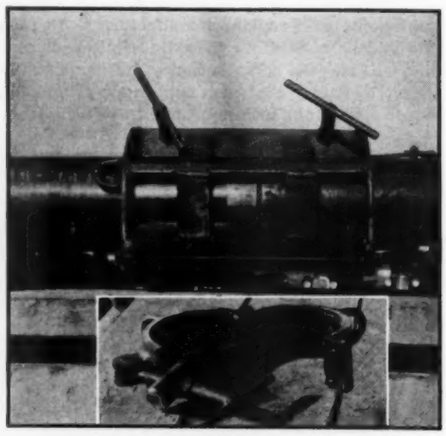


Fig. 2—Pickup and lineup clamps

that we accomplish this in a different manner. We use a "Y"-shaped device attached to the tubing board. This device is counterweighted so that it rotates back out of the way except when actually held down in position by the weight of the man on the stabbing board.

In using this device it is necessary to spend possibly 15 to 20 minutes in lining up the first joint of pipe and clamping the "Y" by means of the bolts on the stabbing board. From that time on, it is necessary only to bring the upper end of each joint of pipe into contact with the two arms of the fork of the "Y," and it will be automatically lined up.

In the running of butt welded pipe, it is necessary to use a slip type elevator. We have also used this type of elevator in the running of belled end pipe, but it would probably be possible to develop an elevator for the belled end pipe which would work on the same principle as a regular collar elevator. If this could be done successfully, there would be some advantage owing to the fact that the slip type elevator is always somewhat slower in handling than the type of elevator which takes hold under the coupling. We have also found it desirable to use a floor spider of the type in which the slips set themselves automatically and simultaneously by the release of a lever from which they are suspended.

There has been a great deal of talk about the danger of running plain end pipe and later discussion may bring out the experience of others in the operation. Our experience today is that we have not dropped or nearly dropped a single joint in the running of quite a number of strings of butt welded pipe. We do, however, think it worthwhile to take the extra precaution of using the automatic floor spider to back up the slip type elevators. There is a good chance that if the pipe were to slip through the elevators due to the pipe hitting a bridge, or for some other reason, that it could be caught by the man holding down the lever from which the slips of the floor spider are suspended.

Needless to say, we give a regular and continuous attention to the condition of the teeth in the slips of our elevators and spiders, seeing that these are sharpened frequently and seeing that this equipment is well oiled and kept in perfect working condition at all times.

One problem which will have to be met as this welding of casing proceeds is that of adjusting the size of the float shoe to the new O.D. obtained by butt welding casing. Usually it is desired to have the float shoe just slightly in excess of the O.D. of the coupling in threaded and coupled pipe. In the case of butt welded pipe, however, the O.D. of the pipe in the weld will be only $\frac{1}{16}$-inch, approximately, greater than the O.D. of the pipe. Inasmuch as one of the arguments in favor of butt welded pipe is that it is possible to obtain closer tolerance between pipe strings, it will probably be necessary in the near future to take up with manufacturers of float shoes the necessity for a float shoe of lesser diameter, to be used on butt welded pipe. To the best of my knowledge, this has not been done, or, at least, nothing has resulted from it if it has been taken up.

The other side to the floor problem is the matter of training the men. The drilling crews which have never before run pipe that was welded are an important obstacle to progress in the beginning of a casing welding program. The routine in the welding of casing being totally different from that used in the running of threaded and coupled pipe, they find themselves more or less at a loss as to what to do. The two floor men who usually handle the tongs and spinning rope in running threaded and coupled pipe have nothing to do unless they are assigned jobs. For that reason it seems reasonable to turn over to them the job of cleaning the welds. As has already been pointed out, this is done now with electric hammers. Besides cleaning the weld, about the only other job the floor men have to do is putting on the pickup clamp and lining up the pipe by means of the lineup clamps.

It is necessary to fully impress on the drilling crews or any others who may be in responsibility the necessity for thoroughly fire-proofing the job before welding is commenced. There must be no gas leakage, and there must be no accumulations of oil, either in the cellar or on the ground around the rig or in the slush pits. If there is such oil, it is necessary that it be removed by whatever means may be required. If the mud in the hole is in proper condition, there will be no leakage of gas from the hole. In dry weather we find it particularly important to clean out from under the rig, where there is often an accumulation of paper, shavings, chips, waste, etc. In any event, the duty must be definitely assigned to someone to make a thorough inspection before allowing the welding of casing to commence.

Test Results

The next problem we have to consider is the joint problem. It is not felt that in handling this problem we will settle definitely the best type of joint, but we have conducted a considerable testing program, and are in possession of data which should be of interest. It was felt that possibly the most important single test that could be made on the welded joint was the full joint pull-out. A number of these tests, therefore, have been made in several different kinds of joints. The joints of casing which we will discuss in this section have been welded by the Carter Oil Co.'s welders.

The joint efficiencies are calculated as the stress developed in the pipe at the time of failure ÷ the cross-section of the pipe × the ultimate tensile strength of the pipe or of the electrode, whichever is the lesser. In determining the joint efficiencies of welded casing, we have somewhat of a problem first, in determining what to consider the joint efficiency. Therefore, in presenting this data it is laid before you sufficiently complete that any who may wish to base joint efficiencies

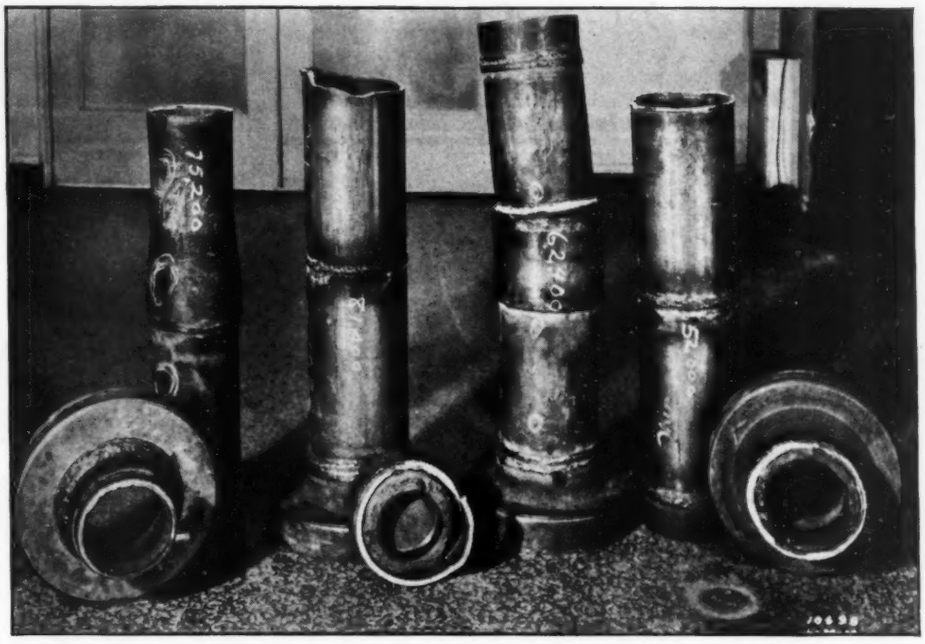
on some other method of calculation will have sufficient data to do so. The problem is simply this: It is, of course, desirable in welding casing to use as low tensile electrode as possible, in order to have as ductile a weld as possible. It seems reasonable, therefore, to select an electrode which will have an ultimate tensile strength equivalent to the minimum ultimate tensile strength guaranteed in the casing by its manufacturer. Thus, if buying a grade of casing in which the manufacturer guaranteed a minimum ultimate of 75,000 pounds, we would endeavor to use an electrode which had an ultimate tensile of 75,000 pounds. This because we know that as we go up the scale of tensile strengths in electrodes we tend to lose ductility in the weld. Now if the manufacturer of this casing has actually made and delivered to us a casing which has an ultimate tensile strength of 90,000 pounds, any weld that will be made in this casing may be expected to fail in the weld if we use an electrode of only 75,000 pounds. The question will naturally arise, then, why not use an electrode of an ultimate strength of 90,000 pounds? The answer is the practical one, that in production work it does not seem feasible for us to determine the actual physical properties of every consignment of pipe. It is to avoid this that the A.P.I. has set up a system of grading pipe in which every grade has certain minimum physical characteristics. In the field, therefore, if we buy pipe to have a minimum tensile strength of 75,000 pounds all that the producer is likely ever to know about that pipe is that it does have an ultimate tensile strength of at least 75,000 pounds.

There is, however, one good argument against using the manufacturer's minimum guaranteed tensile strength in computing joint efficiencies, and that is that in the pull out tests that have been made on threaded and coupled casing to determine the joint efficiencies had with threads and couplings it is said that the actual average strength of the casing was used instead of the manufacturer's minimum. Therefore, for the sake of comparison it is more uniform to use some such average figure than the manufacturer's minimum. However, this is felt to be so only for the sake of making this comparison, and it will quickly be seen by anyone making this comparison that the average welded joint is so much more efficient than the average threaded and coupled joint that there is nothing to be gained by harking back continually to such a comparison. In the future, what we are really going to want is a joint efficiency which we may be able to assume, based on the same factors upon which we design our casing strings, namely, the minimum physical characteristics of the steel.

In going over the data in Table 1, attention is called to the fact that in some cases failure took place in the sample outside of the weld and before the full strength of the pipe had been developed. These failures were chiefly due to eccentric loading, which in turn was due to improper preparation of the samples. In the case of joints failing outside of the weld, we have tentatively given them 100 per cent joint efficiencies, although we are perfectly willing to admit that this is questionable, and on such joints question marks have been placed after the joint efficiencies to call attention to them.

Tables 2 and 3 contain the chemical and physical analyses of the casing shown in Figures 3, 4 and 5.

Attention is called to the fact that in no case does the carbon content exceed .34 per cent.



1 2 3 4

Figure 3

TABLE 2—CHEMICAL ANALYSIS OF PIPE

Sample No.	Carbon per cent	Manganese per cent
1	.22	1.16
2	.32	1.65
3	.30	1.63
4	.34	1.66
5	.30	1.63
6	.32	1.63
7	.30	1.64
8	.22	1.16
9, 10, 11	.32	1.63

TABLE 3—PHYSICAL CHARACTERISTICS OF PIPE

Sample No.	Yield strength	Ultimate tensile strength	Per cent elongation in 2 inches
1	69,500	80,000	28.6
2	98,000	110,000	23.0
3	94,000	105,900	25.0
4	103,900	113,200	21.0
5	94,000	105,900	25.0
6	102,300	111,000	21.5
7	99,300	118,200	21.0
8	67,300	81,250	32.1
9			
10			
11			

5 6 7 8

Figure 4

9 10 11

Figure 5

In connection with these tests of this particular casing, another phase has been investigated to a slight extent, and the results tabulated in Table 4. The issue is this: There is a trend in the manufacture of tubing for oil well casing at this time to increase the setting depths of this tubing by increasing the yield point in compression by cold working. The question arises, then, as to what effect welding has upon such tubing. For that reason, six coupons were cut from the 8⅝-inch samples which we have been discussing, and the yield point and ultimate tensile strength of two of these were determined without giving them any further treatment. The other four were heated in a band about 1½ inches wide, to a bright red, this band being transverse to the longitudinal axis of the coupon and approximately equidistant from the two ends. By heating this pipe up, we intended to simulate the result of the high temperature of welding on cold worked steel. The results had will be found in Table 4.

TABLE 4

Specimen No.	Yield strength lb./sq. in.	Ultimate strength lb./sq. in.	Per cent elongation in 2 inches	What was done to specimen
1	96,500	111,800	22.0	As received
2	98,000	108,100	25.0	As received
3	69,500	105,600	28.0	Heated
4	69,200	101,500	30.0	Heated
5	64,000	101,500	30.0	Heated
6	65,500	103,000	30.0	Heated

It will be noted that what happened was that the increased yield point due to cold working was largely neutralized, but that the ultimate tensile strength, while reduced, was reduced to only a very small extent (approximately 6 per cent). As would be expected, the percentage of elongation was increased. From this we will be interested in two things: First, the effect that will be had on tensile strength or joint efficiency of such casing when welded, and the answer seems to be that the failure will probably occur in the stock of the pipe immediately adjacent to the weld. Second, we are interested in the question of what will be the effect of welding cold worked casing upon its setting depth. It is only natural that one should ask what has happened to the increased setting depths accomplished by cold working if the cold working has been neutralized by welding. The answer is fairly obvious. In the use of the electric arc to effect the welding, the casing is heated up such a short distance from the weld that the narrow band of low yield steel immediately adjacent to the weld is not enough to cause collapse to occur at lower pressures.

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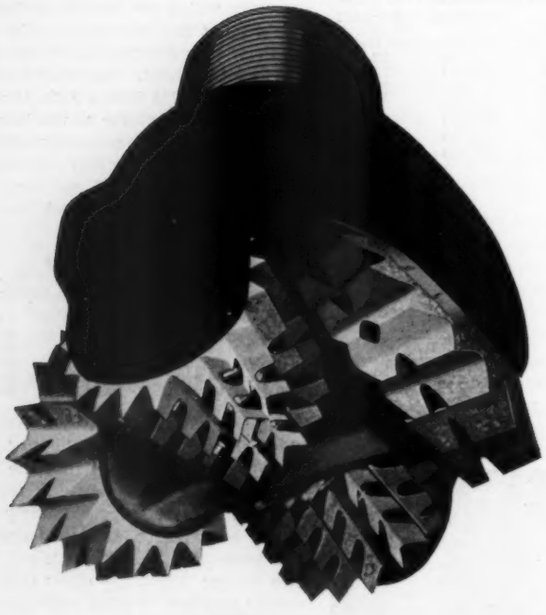


REED DK-2
ROLLER BIT

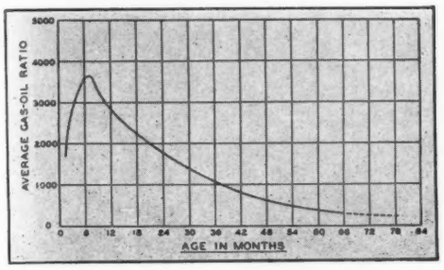
REED DK-3
ROLLER BIT

WHEREVER THERE IS ROTARY DRILLING

Gas-Oil Ratio in Flowing Wells

By R. J. SULLIVAN
The Carter Oil Co., Fairfax, Okla.

Recognition of the function of natural-gas energy in the recovery of underground crude oil compels recognition of the need for gas conservation. Regardless of the manifold differences of opinion on reservoir classification, the facts persist that many so-called combination pools are produced in such a manner that compressed gas, associated in a free or dissolved state with the oil, becomes the chief propulsive agent, and that hydrostatic pressure and gravity are allowed to play only subordinate parts. Advancing knowledge of the behavior of sub-surface oil and gas has, of course, augmented emphasis upon the purpose and importance of producing oil with as low per-barrel volumes of gas as possible. During the past several years theoretical views as to the effect of gas conservation on economic exploitation and ultimate yield have gathered a background of convincing tangible results.



Curve covers averages on 178 wells at Santa Fe Springs, Signal Hill, Athens, Richfield, and Ventura.

Course of Average Gas-Oil Ratios as Withdrawal Progresses (After Marsh).

Figure 1

By all odds, the foremost single factor in promoting realization of the benefits proceeding from proper utilization of gas energy has been proration. From its early makeshift beginnings, obligatory curtailment of withdrawal has incidentally served as an unescapable object lesson highly suggestive of what should and can be done toward efficient production. As a rule, the competitive situation in a flush but restricted pool in the United States prevents any one operator from devoting more than casual attention to gas-oil ratio control. The growing popularity of cooperative or unitized development, together with modern policies of block leasing, tends to minimize difficulties of this ancient sort. Proration, both voluntary and compulsory, has lately gone a step further toward attaining the object of true conservation by offering a definite incentive to the producer who is able to lift his allowable quota at favorable gas-oil ratios. Through direct governmental order or inter-operator agreement, nearly all of the leading oil-producing states have sought to eliminate waste by introducing well spacing, sub-surface pressure, or gas-oil ratio elements into some of their regulations. Ordinarily, the measures aimed specifically at gas preservation stem from the concept of volumetric withdrawal as set forth by the Institute's Topical Committee on Allocation of Production.[1a] Application has thus far been confronted by strong opposition, numerous exceptions have been made, and enforcement has not been rigid. Powers conferred by existing conservation statutes have seldom been fully invoked. Nevertheless, the troublesome, omnipresent "law of capture" is being weakened by modern proration. Examples of production allocation designed to penalize high gas-oil ratios are multiplying steadily. Because of special commitment to ultimate yield, several domestic pools, such as the pressure-maintenance projects throughout the country, expressly contemplate low gas-oil ratio production. Nor have the courts altogether refrained from placing pool welfare ahead of that of the individual, so that ultimate recovery might actually be held a prime objective.[2] The industry is, from every standpoint, surely finding itself in a better position to employ advantageously the progress of intelligent investigation.

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

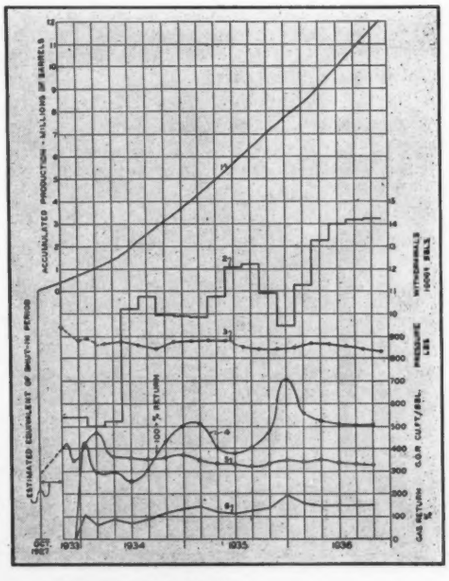
Appreciation of Causes

There is no need for dwelling here upon the generally-admitted causes of high gas-oil ratios in flowing wells. Although a rather wide variety of circumstances may be encountered among particularized cases, the significance of sub-surface pressure, of reservoir-fluid properties, and of permeability in relation to formation arrangement, structural position, and depletion is commonly understood. It is sufficient to repeat that the typical pool giving rise to an acute gas-control problem is one in which the equalizing force of water-drive is either absent or rendered unavailable by withdrawal rate. Thus the plotted gas-oil ratio of a simple gas-drive pool traverses an upward trend toward a peak usually beyond the first pumping stage where slippage losses become extreme; thereafter a decrease in ratio sets in toward exhaustion of practically all gas. An example in Fig. 1 is borrowed from H. N. Marsh.[3] Depending upon the degree of curtailment and pressure support imposed, the curve shows an improved course through closer extremes. In the same respect, instances of what may be accomplished through proper utilization of natural forces heighten appreciation of the subject's allusions. Fig. 2 carries a graphic record of Peru's Mile Six Pool, opened in 1927, and placed on a full producing plan under gas-injection methods of pressure maintenance in October of 1933. It consists of a productive section of some 250 ft. between up-dip faults and edge water. By restoring to the sand a gas volume sufficient to compensate for the difference between water encroachment and fluid withdrawal, and by careful attention to gas-cap advance, the gas-oil ratio has been almost exclusively held between 300 and 400 cu. ft. per bbl., or at approximately its saturation value under the sub-surface-pressure average maintained. Had the pressure decline observed at the beginning of development been permitted to continue, the recovery by natural flow would not have reached more than an estimated 33 per cent of its cumulative figure at the close of 1936. Besides Cumarebo, Venezuela, and other foreign pools, Hilbig and Sugarland (Texas) disclose modified examples of suiting withdrawal to pressure conditions so that gas-oil ratios have been suppressed. Oil which can be extracted without admitting free gas to the well is accompanied by the saturation or minimum possible formation gas-oil ratio of highest efficiency at which all control methods are checked in theory.

We are primarily concerned, however, with the presence of expanding free gas at pressures and in volumes so large as to constitute a control

(Continued on Page 156)

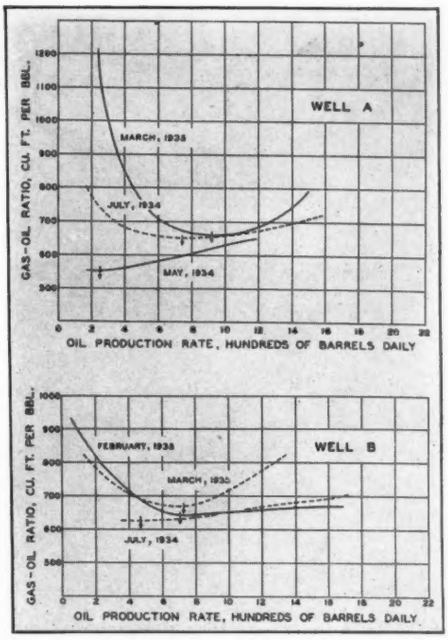
[a] Figures refer to bibliography.



1. Accumulated production.
2. Average withdrawal per calendar day.
3. Average reservoir pressure (at 2,200 ft. below sea level).
4. Gas-oil ratio returned.
5. Gas-oil ratio produced.
6. Per cent returned of gas produced.

Condensed Operating Chart on Mile Six Pool, Peru.

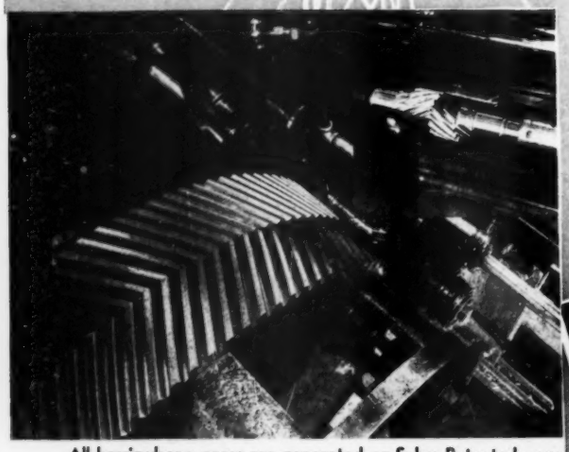
Figure 2



Gas-Oil Ratio Characteristics, Lucien Wells.

Figure 3

The Heart of a "A Good Heart is



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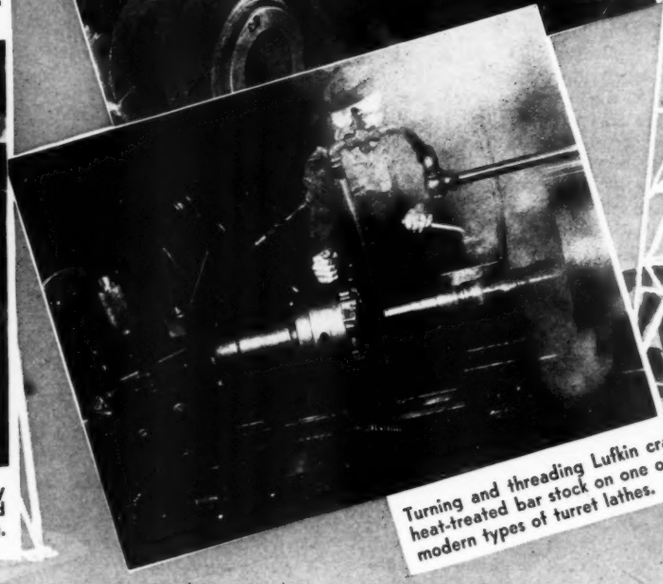
The most modern type of turret lathe — one of a battery performing similar operations. Note that boring, facing and turning rough and finish cuts are completed in one operation.

What is said to be the most expensive and the most accurate bar yet built for precision boring of parallel bearings. This photo shows cover removed revealing its particular operation.

This shows start of boring operation. Every Lufkin Unit is bored to absolute accuracy with similar jigs and with similar bars.



Turning and threading Lufkin crank pins from heat-treated bar stock on one of the most modern types of turret lathes.

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Of course, he had reference to the human heart. But, after all, the heart of any piece of machinery is just as important, relatively, to the worth of a particular machine as the human heart is to the soul of man.

● Only materials of the finest character—the very best now obtainable—go into the making of Lufkin Units.

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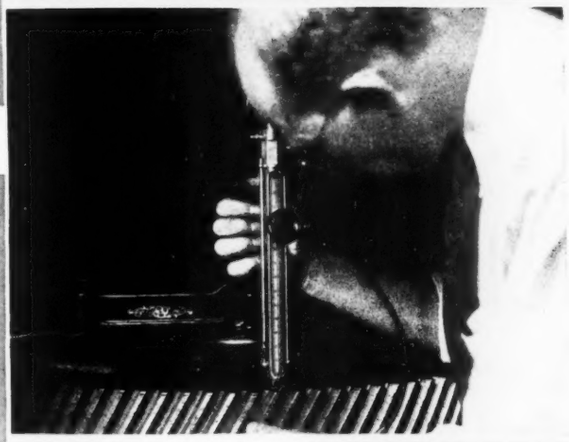
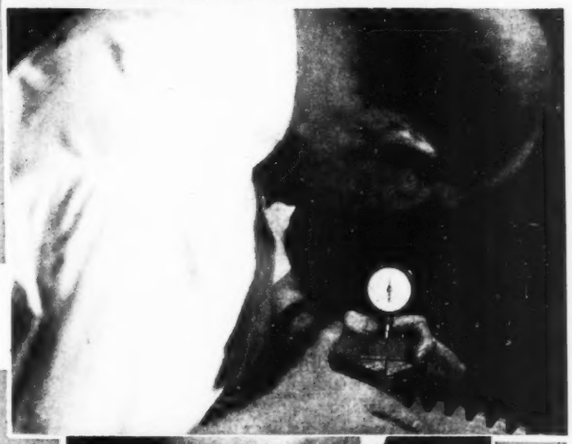
● Lufkin has always produced Units with "Hearts worth Gold."

Testing pinion shaft blank for eccentricity before generating herringbone teeth. Accuracy, here, is of extreme importance.

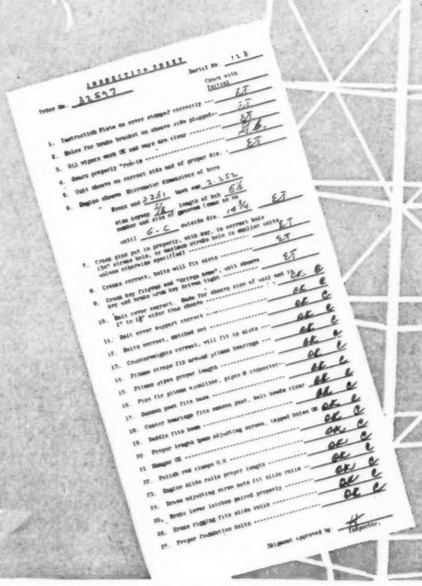


Testing gear teeth for hardness.



Accuracy of tooth formation meets most rigid inspection.

Herringbone gear cutters must meet final inspection after grinding before being sent to gear generators.

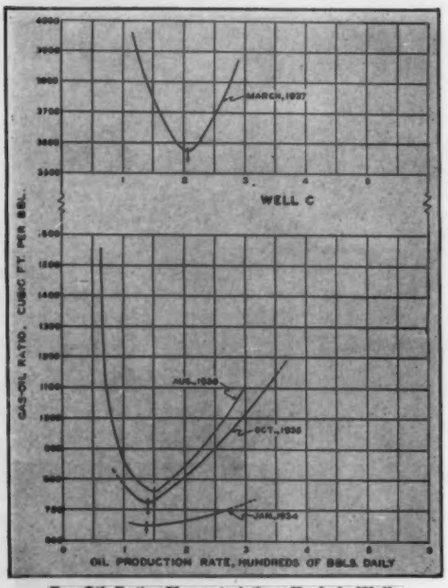


Final inspection blank that has passed from operation to operation for the final "O. K." by the inspection department and after gears have been "run-in." The unit is now ready for shipment to customer.

problem removing any doubt of a well's ability to flow. This paper proposes next to discuss in order those control means for which conspicuous claims are put forward, reviewing their qualifications on a common basic norm. It should be kept in mind that, if all other factors might be duplicated, a thick formation of high permeability can be expected to produce at lesser gas-oil ratios than one of comparatively thin section and low permeability.

Well Characteristics

Returning, then, to the more frequent case where free gas is present, it is obvious that, since they are different fluids, oil and gas within a reservoir do not behave identically when impelled by a given differential pressure between the sand and a producing well. Hence, the proportion of gas delivery to oil delivery may be varied by alteration of the differential responsible for flow. So it is that by regulating the bottom-hole flowing pressure, as conveniently indicated by oil-production rate, the performance of a well with respect to gas-



Gas-Oil Ratio Characteristics, Keokuk Wells.

Figure 4

oil ratios may be determined. It has been the writer's observation that most wells display characteristics either of decreasing ratios at lowered back pressures or of decreasing ratios involving an optimum intermediate production rate beyond which ratios again incline higher. Provided tests are trustworthy and complete, many more wells may be placed in this second group at some time in their lives than is perhaps supposed. It is not at all rare, after examining material purporting to represent gas-oil ratio data, to discover that equilibrium while taking readings was doubtful, that all of the gas released at atmospheric conditions was not measured, or that the range of testing was not comprehensive enough. The fore part of characteristics like those presented in Fig. 3 to 7 is interpreted as due to gas velocities inadequate to move any but relatively small quantities of oil through either or both the formation and the eductor string to the surface. The reversal side of such curves may conceivably be attributable to excessive release of gas from solution in conjunction with approach of critical oil flow through the formation. The point stressed is that a characteristic can usually be established that will offer a rate of oil extraction distinguished by a minimum gas-oil ratio. Supplementing bottom-hole differential data and reservoir-fluid analysis, factor curves are very valuable in regulating producing rates between wells so as to strive for maximum reservoir efficiency. No pretense is made that the minimum ratio flow of individual wells is the standard for gauging pool optimum.

A single characteristic may not prevail throughout the life of a well, particularly if it is exposed to cap migration. Gas-factor-production-rate histories from wells in certain sectors suggest a disposition of characteristics to move upward and outward from the origin; i.e., the optimum rate and minimum obtainable ratio increase with passage of time. Records of tubing characteristics taken in the Lucien (Oklahoma) Pool are supplied in Table 1, with complete curves shown in Fig. 3. It appears that, as depletion progresses here and reservoir pressure declines, the locus of the gas-oil ratio curve in relation to a prescribed set of coordinates is continuously positive for both x and y values. Table 2 details of which are given in Fig. 4 and 5, is taken from sample wells in the Keokuk Pool (Oklahoma) producing from a relatively thinner and less permeable sand than at Lucien. Note that U-shaped characteristics are evolved throughout, becoming plainer as the wells grow older. Likewise, the optimum rates are considerably lower from the less prolific wells in Fig. 4 and 5. In Table 3 and Fig. 6 and 7 are sample records from the South Burbank Pool, where sand thickness and predicted recoveries fall between those of the other two pools cited. Again, as depletion progresses on the one hand and gas-cap encroachment intensifies the situation on the other, the control curves move positively away from the origin. The September 1937 characteristic from well "F," where large quantities of free gas are present, finally terminates at its then current tubing capacity. Past this stage wide-open flow yields the minimum gas factor, although not necessarily superior reservoir efficiency from a number of such wells. At both Keokuk and South Burbank there exists some indication that another feature of repeated characteristics up to such a point is their becoming sharper or somewhat V-shaped after beginning at a comparatively gentle inflection during the wells' early life. Accordingly, the scope of this method of control in the latter periods becomes narrower, more difficult to stabilize. Elevation of the minimum ratio per well is known to be reflective of a pool's over-all tendency to produce at consistently higher factors.

(Continued on Page 161)

TABLE 1—GAS-OIL RATIO CHARACTERISTIC RECORD, LUCIEN WELLS

Date	Minimum gas-oil ratio (cu. ft. per bbl.)	Accompanying production rate (bbl. per day)	Static sub-surface pressure (Lb. per sq. in.)	Accumulated oil production (barrels)
WELL "A"				
May 1934	552	260	1,915	65,487
July 1934	645	735	1,814	87,404
March 1935	660	805	1,709	134,531
WELL "B"				
July 1934	625	475	1,841	23,330
February 1935	645	700	1,727	117,129
March 1935	665	730	1,712	122,825

TABLE 2—GAS-OIL RATIO CHARACTERISTIC RECORD, KEOKUK WELLS

Date	Minimum gas-oil ratio (cu. ft. per bbl.)	Accompanying production rate (bbl. per day)	Static sub-surface pressure (Lb. per sq. in.)	Accumulated oil production (barrels)
WELL "C"				
January 1934	650	135	1,720	1,656
October 1935	730	140	1,564	43,079
August 1936	760	150	1,495	57,130
March 1937	1,575	205	1,436	68,184
WELL "D"				
October 1935	530	110	1,630	83,117
July 1936	680	152	1,490	117,231
March 1937	1,145	235	1,425	146,411

TABLE 3—GAS-OIL RATIO CHARACTERISTIC RECORD, SOUTH BURBANK WELLS

Date	Minimum gas-oil ratio (cu. ft. per bbl.)	Accompanying production rate (bbl. per day)	Static sub-surface pressure (Lb. per sq. in.)	Accumulated oil production (barrels)
WELL "E"				
December 1934	600	140	1,035	46,283
September 1935	1,180	185	916	106,095
August 1936	2,550	220	852	150,812
September 1937	4,470	405	743	153,722
WELL "F"				
June 1936	800	225	785	14,515
September 1936	935	258	767	30,562
September 1937	1,910	305	645	132,032

TABLE 4—EFFECT OF SUB-SURFACE CHOKE—DIAMETERS AND SETTING DEPTHS, SOUTH BURBANK

	Tubing potential (barrels per day)	Total depth (feet)	Tubing point (depth in feet)	Choke diameter (inches)	Choke setting depth (feet)	Apparent optimum production rate — By observation — Barrels per day	By observation — Gas-oil ratio	By curve — Barrels per day	By curve — Gas oil ratio
Well "G"	656	2,767	2,727	Surface	choke	308	2,372	305	2,420
			2,727	0 250	2,697	159	3,588	...	....
			2,727	0.375	2,700	292	2,942	...	....
			2,727	0.500	2,700	411	2,755	...	....
Well "H"	584	2,870	2,850	Surface	choke	252	939	255	970
			2,850	0 250	2,810	249	1,193	...	....
			2,850	0 375	2.803	397	1,309	...	....

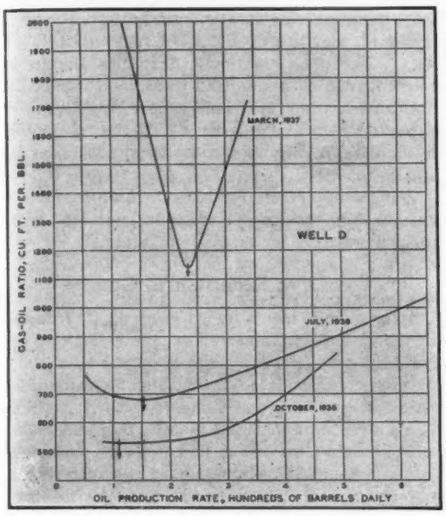
TABLE 5—ADDITIONAL FLOWING YIELD THROUGH SMALL-DIAMETER TUBING, CUMAREBO POOL

Well No.	Date installed	Size of choke (inches)	Daily average production (barrels) March 1936	Daily average production (barrels) April 1936	Gas-oil ratio April 1936	Gas-oil ratio March 1936	Production through 1-in. tubing (barrels)	Accumulated total production (barrels)
1	9-21-35	1	165	166	301	385	36,756	174,655
2	2-19-36	7/8–1	81	73	1,925	1,639	6,524	527,882
3	10-17-35	3/4	130	111	230	196	27,364	184,610
4	2-14-35	5/8	172	180	117	232	8,433	255,364
5	10-23-35	1/4	...	75	....	1,747	6,833	57,226
6	8- 2-35	1/2	109	74	1,194	1,917	28,500	90,561
7	9- 6-35	1/2	127	103	233	430	23,667	38,215
8	2-12-35	....	98	...	127	....	3,015	76,629
9	9-23-35	....	...	...	....	....	13,870	38,331
10	2- 3-36	1/4	43	44	909	785	3,131	12,462
Totals		....	110	106	600	714	158,093	1,455,935

In view of the diverse flow peculiarities of oil and gas, a gas-oil-ratio reading is almost meaningless unless accompanied by reference to appropriate production rate. Care should be exercised in evaluating results of other control methods to ascertain whether, if treatment does not include actual alteration of production rate, there is not some adjustment of differential on the oil-bearing sand, the gas-bearing sand, or both.

Working Fluid Levels

The explanation for effectiveness of producing through tubing set deeply as compared with tubing set near the top of the pay formation lies in precisely this latter point. Through fluid-level control, the pressure differential on one portion of the formation relative to that on another portion may be regulated so as to bring about reductions in gas-oil ratio. It is sometimes possible to combine regulation with a fluid-head sealing effect above the tubing entry so that free gas is confined to the casing. As a matter of fact, at the Mile Six pressure-maintenance project it has been feasible to inject residue gas into the upper reservoir through the casinghead of a well producing simultaneously from the oil-bearing section of the same thick, permeable formation with a low gas factor. Generally, however, the fluid-seal method is at best a temporary, unstable expedient in accordance with the permeability and sand thickness present and with the degree of free-gas encroachment. In marginal cases, very watchful manipulation of tubinghead and casinghead pressures is required. The deep-tubing method, fundamentally dependent upon thick producing sections and high productivity indices, has been discussed at length in technical petroleum literature; and substantial, convincing results have been set down.[3] It was reported in cases to be of passing value at Rodessa, while no perceptible lasting benefit has been detected from producing through tubing hung near bottom in the relatively thin and tight reservoirs of Oklahoma where a decided gas cap has engulfed wells.



Gas-Oil Ratio Characteristics, Keokuk Wells.

Figure 5

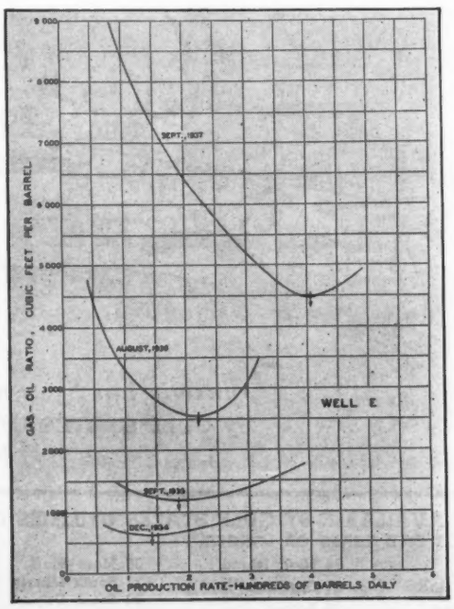
Betterment of gas-oil ratio by application of gas-lift, aside from its familiar application to wells which have come to a heading phase of deficient gas or pressure, falls into this same category of fluid-level control in turn referable to differential-pressure adjustment.

Flow-String Design and Sub-Surface Chokes

Claims for the efficiency of tapering tubing and bottom-hole choking are not always properly qualified. In as much as given conditions of pressure differential across a sand face release definite volumes of oil and gas, any notable improvement in the formation gas-oil ratio cannot legitimately be ascribed to either of these contrivances. Some discredit has been thrown upon the soundness of the theory behind tapering tubing.[2,4] It has logically been held that slippage and friction tend to compensate each other to an extent that the net effect is almost negligible as against that of other considerations.[5,6] Much more can be accomplished by treating slippage in the formation itself. Avoiding the controversial matter of the type of gas expansion which takes place in a vertical pipe, it is certain that at high pressures rather small volumes of gas are sufficient for lift. But, palpably, if the formation ratio cannot be reduced below a figure far greater than the work requirement, nothing is to be gained from elaborating upon flow equipment. There is no denying that gas unnecessary to the work of lift is a hindrance to efficient tubing flow. Still, since gas delivered to the well bore must normally emerge at the surface, the question inevitably comes down to prevention of gas escape from the formation.

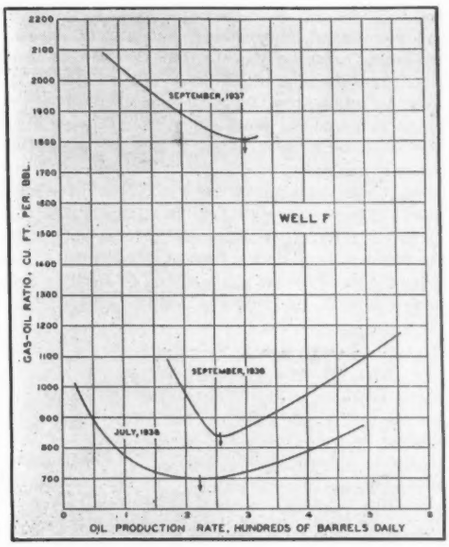
Even in theory, bottom-hole choking aims solely to utilize to better advantage the expansive force of gas by localizing back pressure at the sand face. As to actually combating free gas originating from the producing sand, bottom-hole choking cannot be expected to reduce gas-oil ratios. Fig. 8 illustrates two specimens from a group of tests conducted in the South Burbank (Oklahoma) Pool, pertinent data being listed in Table 4. The procedure followed was to take settled measurements of flow through sub-surface orifice openings of different diameters set at various depths in the tubing string. Well "G" exemplifies wells making large quantities of free gas, while well "H" is typical of findings at producers of less serious volumes of free gas.

Both surface and sub-surface choke characteristics have been plotted against production rate. When beaning well "G" at the surface, the observed minimum ratio was 2,372 cu. ft. at a flow of 308 bbl. per day. Chokes ranging in diameter from ¼ to ½ in. were then run at depths from 630 ft. to 30 ft. above the perforations. In varying the chokes' submergence, no appreciable benefit was apparent—the gas-oil ratio difference amounting to only 220 cu. ft. per bbl. over any setting range for a given size, with the deeper settings perhaps preferable. Well "H" merely illustrates identical results, the flow characteristics naturally exhibiting themselves in more subdued fashion due to the lesser effects of free gas. It is felt, in all justice, that bottom-choke readings could reasonably have been incorporated into the orthodox well characteristics. The only gain by sub-surface choking lay, as one might have anticipated, in securing sustained flow rates below the depressed rate limitations of surface chokes; in other words, so far as free gas was concerned, sub-surface choking was of no aid whatever, merely proving again its known utility in preserving flow where surface choking was unable to do so for more than a brief time at expansion conditions against high back pressures. Here is virtually no difference from simulation of the state existing when a well's pressure or relative gas productivity has actually declined to cessation of natural flow.



Gas-Oil Ratio Characteristics, South Burbank Wells.

Figure 6



Gas-Oil Ratio Characteristics, South Burbank Wells.

Figure 7

Sub-surface chokes and small-diameter tubing occupy a very real and often prominent place in the altogether-different connection of prolonging flow life. An interesting example was established in the Cumarebo Pool of eastern Venezuela by installing 1-in. tubing in several wells which had declined to either the heading or the pumping stage. Table 5 consists of an operating summary derived shortly after the program went into effect, and expresses results for the group in terms of barrels of production.

Production from eight wells included came to only 4 bbls. per day than during the preceding month, and had registered by the end of April a 12-per-cent addition to the original accumulated total of natural-flow oil. Comparable figures on gas-oil ratios before and after installing small tubing are not available. The object in mind was entirely to postpone artificial lifting. Often, in accomplishing this at the final stage of natural flow, prolongation is marked by lower gas-oil ratios. Few claims are any longer heard for the efficacy of small tubing in overcoming free gas.

Intermittent Flow

Laboratory experiments with partly-depleted sands susceptible to secondary-recovery operations have been correlated with field observations to indicate that capillary movements of reservoir fluid so as to bring about a more uniform saturation lead to improvement of gas factors.[1] Undesirable ratios are sometimes remedied in repressuring practice by a shut-down or differential-pressure adjustment. With favorable depletion status and permeabilities, the same practice is of assistance in handling flush production. Intermittent-flow methods have been resorted to throughout the past two years in coping with a free-gas problem at San Pedro, Argentina. It has also been reported as of some help at Rodessa (Louisiana-Texas), South Burbank, and Keokuk. An instance occurred at Keokuk not long ago when a well located over the

gas cap in close proximity to a high-pressure injection well was opened after 30 days of idleness and made 8.5 bbl. per hour for 11 hours at a gas-oil ratio of 895. An increase then took place to the same 2,150-cu.-ft.-per-bbl. value at a lesser rate of flow which had prevailed before shutting in. South Burbank wells have behaved in nearly the same manner. Further facts of interest arising from this phenomenon will be discussed presently.

Acid Treatment

In lime-producing areas, such as West Texas and New Mexico, evolution of acidizing technique has encouraged improvement not only of the oil-producing capacity of wells, but also of their relative oil and gas productivities. Eccentially, acidizing is tantamount to a permeability increase. When its action can be restricted to an oil-saturated section, meanwhile protecting the gas zone, the result is analogous to differential-pressure adjustment. There are a number of variations in the procedure of introducing acid and auxiliary fluids into a well with the intent of improving its gas-oil ratio. The following excerpt[8] is from the Goldsmith Pool, Ector County (Texas) Engineering Committee Report of May 31, 1937:

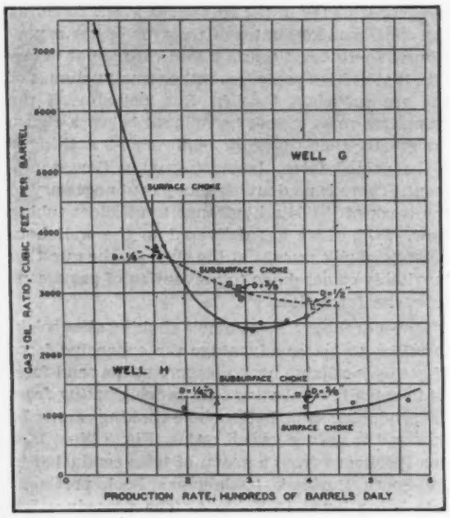
"The operators are urged to exhaust all possibilities of acid treatment before resorting to shooting their wells. Shooting limits the possibilities of corrective work in event of high ratios or water encroachment. From a study of available data, it is believed acid will stimulate production as well, if not better, than shooting, outside of a few wells where it is necessary to shoot to obtain commercial production.

"Best results with acid are being had by using two-stage, two-pump treatments—the operators using 1,000 to 2,000 gal. for the first stage, and 3,000 to 4,000 gal. for the second stage, oil being pumped down the annular space during treatment to confine the acid to the pay section, thus eliminating the possibility of acid going into the upper gas-bearing parts of the pay."

Issued by the same body on July 31, 1937:

"A new type of acid treatment was tried on Goldsmith No. 26, a high-ratio well, which proved very successful in lowering the ratio. Instead of loading the hole and pumping in acid as is usually done, the casing was merely closed in, but the hole not loaded. Enough acid was then pumped in to cover the face of the pay, in this case 126 gal. This 'shot' was allowed to stay on the face of the pay for 15 min., and then swabbed out. During treatment, casing pressure was 1,225 lb. and tubing pressure 150 lb. On the second stage, the acid volume was increased to 378 gal. This was pumped into the formation slowly at a tubing pressure always less than 150 lb. This second acid was also allowed to stay in the formation 15 min. and then swabbed out. A last stage of 756 gal. was pumped in also at a tubing pressure less than 150 lb. and swabbed out after 15 min. This made a total of 1,260 gal. used. Before acid, the well flowed at the rate of 1,344 bbl. per day with 15,000 M.C.F.* gas and ratio of 11,161. After acid, the well flowed at a potential rate of 2,048 bbl. per day with a gas volume of 14,147 and a ratio of 6,908. This is an increase in potential of 523 per cent, and a decrease in ratio of 4,253 cu. ft. per bbl. On a re-test through 2-in. tubing with perforations on bottom, the well flowed at the rate of 1,173 bbl. with a ratio of 2,630. . . . . The treatment described herein is recommended as a standard treatment, especially applicable to high-ratio wells where it is desirable to treat only the lower or oil pay, thereby obtaining an increase in oil with a resulting decrease in ratio."

Wells whose ratios, remedied by an initial treatment, tend in time to rise are later re-treated with a proportionately larger stage of acid.



Effect of Varying Sub-surface Choke Diameter and Submergence on Gas-Oil Ratios.

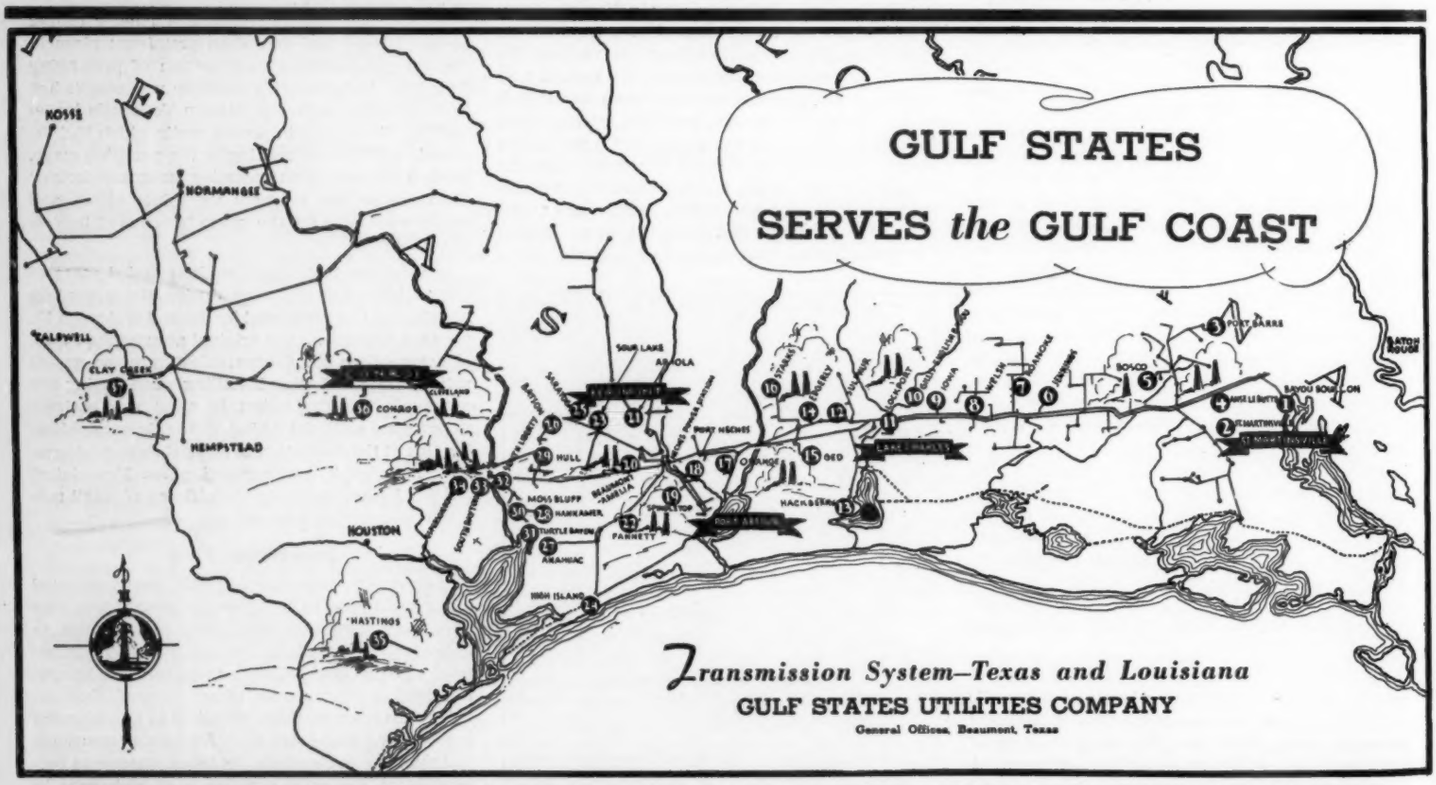
Figure 8

Positive Exclusion of Gas

After a well has been so exposed to free-gas migration that its characteristic climbs to an excessive height attended by the production of very large gas volumes, it is felt that the only remaining method of curtailing gas escape from the formation is a positive shut-off. Just as any other successful control method, viewed in its essentials, this quite plainly amounts to alteration of the differential pressures among oil-bearing section, gas horizon, and well. The utter absence or undependability of any true barrier stratum separating upper gas from

(Continued on Page 166)

*Thousand cubic feet.



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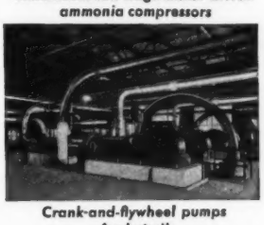

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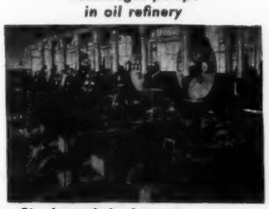

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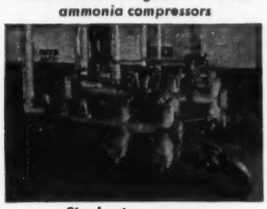

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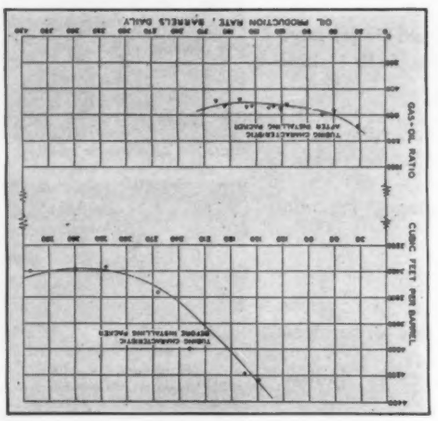
underlying oil forces reliance of a mechanical shut-off upon an effective difference between transverse and bedding plane permeabilities. Many sedimentary deposits possess this quality.

Packers

In the South Burbank Pool, where the base of the gas-invaded sand must be determined experimentally in each individual well treatment, a successive trial process is prudent in physical exclusion of gas. The local situation, together with the special under-set packer devised to facilitate inexpensive testing, has been described in an earlier publication.[9] A typical case of final formation packer results at a high gas-oil-ratio well is shown graphically in Fig. 9. Note that the minimum ratio obtainable prior to the packer installation was 3,363 cu. ft. at a daily rate of 324 bbl. The lower-curve data gathered after final setting of the packare drafted in the lower curve. It can readily be seen that, over the entire range of readings, there is no such fluctuation of gas factor at changed production rates as in the first characteristics—the new optimum value being 480 cu. ft. at 168 bbl. per day. From the fact that the well's tubing capacity was somewhat reduced, that the curve inflection assumed a form linked with the well's youth, and that both minimum factor and appropriate production rate shifted back toward the coordinate origin, it seems that for all immediate purposes the lower producing section has been reverted to semblance of early life.

It is very simple, but probably undesirable, at South Burbank to set formation packers arbitrarily low in the pay sand and thus obtain a greatly-reduced gas-oil ratio at the risk of isolating oil which might later be difficult to recover. Consequently, formation-packer installations are made as close as practicable to the gas-oil contact. Subsequent to initial results of the sort provided in Fig. 9, investigation revealed that, given a sound mechanical seal, prime factors then entering into the well's performance are gas-coning and drainage through the hole's area of reservoir influence. Charted continuous records gathered with recording instruments over a period of the past five months, and illustrating general lines of conduct

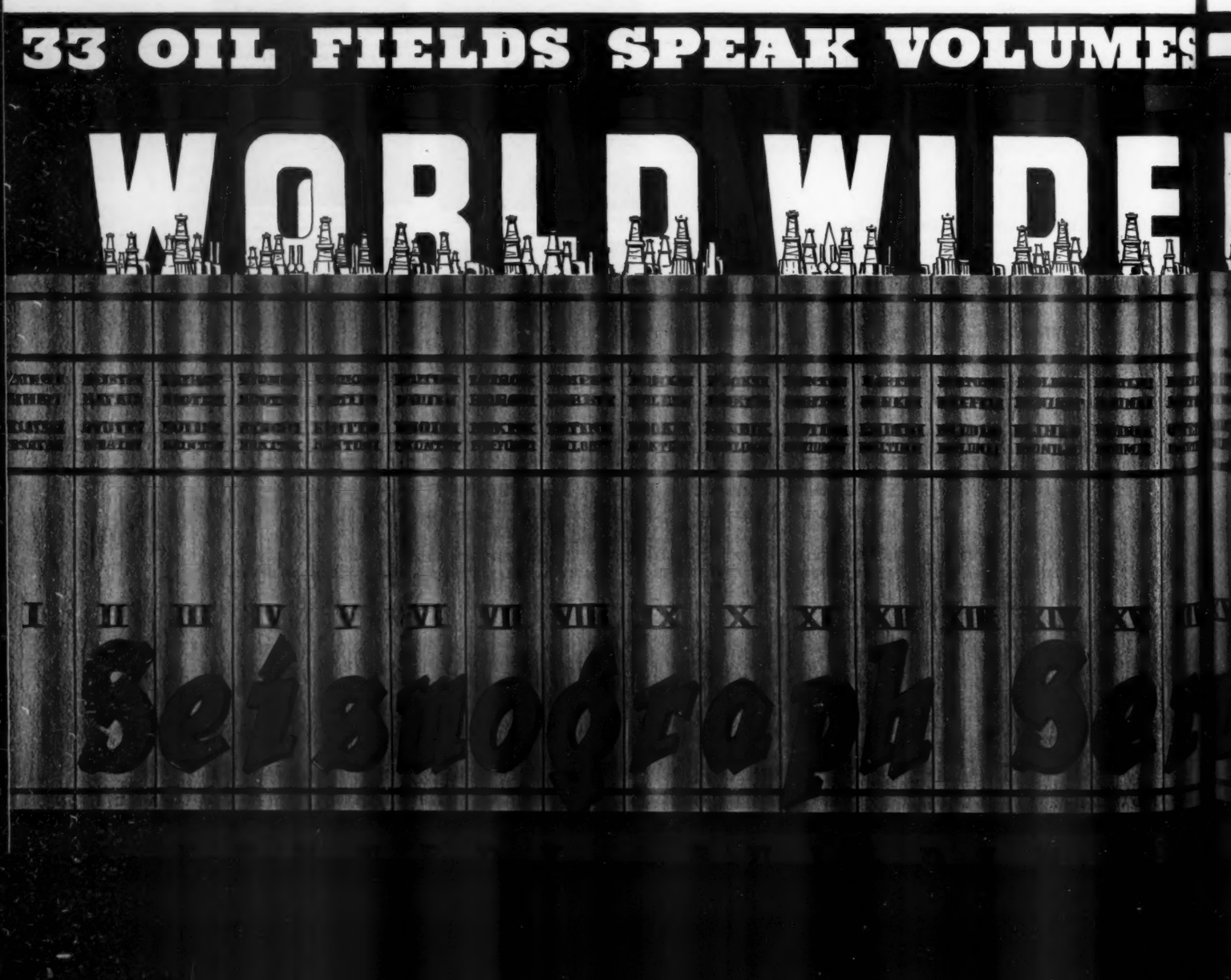


Effect of Formation Packer on Gas-Oil Ratio.
Figure 9

encountered, are furnished in Fig. 10 and 11. A summary of the protracted test data is made up in Table 6.

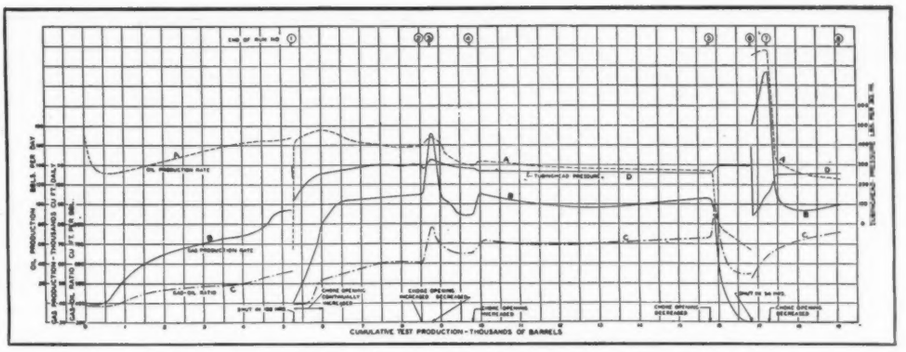
Well "J"—This case is believed to be representative of a setting in which a relatively impervious stratum intervenes between the oil and the zone pervaded largely by gas. At the beginning of the record in Fig. 10 the well continued for some time to purge itself of "dead" oil used for killing. Thereafter both oil and gas production increased slowly at gas-oil ratios never exceeding 564 cu. ft. per bbl. When the well was shut in and allowed 108 hours in which to equalize, it began to produce at improved ratios and with an oil rate approaching constancy, but without so pronounced a display of these proclivities as found in a well where cap gas cones downward into the producing hole. Some irregularity was introduced between third and fourth runs in meeting incidental production requirements. After equilibrium had been reached at the outset of the fifth run, nearly constant volumes of oil and gas at a practically constant tubing-head pressure were registered. Production was again curtailed for a span of 15 days covered by the sixth run, after which the well was shut in for 54 hours. When re-opened for two days, the flow was felt to be dangerous to the packer seal, and was choked down toward a level between 120 and 140 bbl. daily. The change was again accompanied by an originally-rising gas factor approaching constantcy. From a minimum of 380 cu. ft. per bbl., or practically the solution ratio, gas factors throughout the entire 141 days did not exceed 786, and displayed averages ranging from 485 to 746 in accordance with the rate of withdrawal. The over-all average for 141 days was 596 cu. ft. per bbl. as compared with an open-hole optimum ratio of 5,470 at the start.

Well "K"—Fig. 11 depicts another sequence of continuous tests taken after the setting of a packer in a South Burbank well of the sort governed only by a relatively slight difference between transverse and parallel permeabilities. A state of head flow is clearly portrayed by the first portion of the record on run No. 1. Thereafter the well began to produce regularly with very little decline in the oil rate, and steadily-increasing gas rates and factors. When the ratio had reached 1,710 cu. ft. per bbl., well "K" was rested for three days and then re-opened. Its performance in next delivering oil at a temporarily



higher rate and gas at a temporarily lower rate from its replenished zone of influence is typical of other packer-equipped wells subject to coning action. The choke setting was left unchanged throughout. The third run resulted in repetition of almost the same characteristics, with the striking development that the gas-oil ratio's ascent decelerated. Another and longer shut-in period followed by another run brought the ratio comparatively rapidly back toward the critical. Next came the fifth and sixth periods of attempting to adjust the downward differential on the gas cap so as to improve both the maximum and the average ratio per phase. No great change was effected through the sixth and seventh runs up to the present stage of the latter, the maximum ratio hovering in the neighborhood of 2,900 cu. ft. per bbl., but remaining responsive to temporary improvement of the average by continued stopcocking. The average factor throughout the entire record embracing 166 days was 2,137 cu. ft. per bbl. as compared with 8,100 minimum prior to packer installation. It has been learned thus far that the more prolific wells require more frequent shut-downs, but likewise that they share a tendency to reach individual maxima evidently consonant with the current stage of reservoir depletion and gas-cap expansion. Not only the averages, but also the criticals or peaks, have been retarded to values far preferable to open-hole factors.

No such complications enter, of course, if an extensive barrier stratum can be found and used as a shut-off point. For instance, another gas-cap well, where drilling logged an unmistakable shale break, produced from below a packer at gas factors approximating the solution ratio and, as subsurface pressures dropped, mounting to only 1,054 cu. ft. per bbl. in three years' time. A high flow rate eventually caused failure of the deteriorated packer element, so that the gas factor abruptly



Production Characteristics of Packer-equipped Well—Little or No Gas-Coning.

Figure 10

rose 300 per cent. Packers have been beneficial in the Quiriquire Pool of Venezuela in conjunction with alternate rest and production duty. Coning of gas was pronounced to be an obstacle there also.

Cementing

Due to its reliance upon a strong peripheral bond, the cementing of pipe against gas sands may fail to obtain a shut-off if an ample amount of cement has not impregnated the walls of the formation at pressures overcoming the pressure of the gas itself. Cementing owes much of its merit to development of the squeeze method and of cement design in recent years. Rodessa's multiple-zone reservoir, wherein uppermost sands produced only gas, with a gradation to deeper combination pays, and where improper completion of many of the first holes aggravates the situation, will serve briefly to exemplify well reconditioning. Test data prior to and after cementing a short string of blank casing opposite two troublesome gas sands above an oil sand at the bottom of the hole are charted in Fig. 12. Attention is directed to the reduction in minimum obtainable ratio from a value drawing a 50-bbl. daily allowable under the pool's proration order to one raising the quota to 225 bbl. daily, while what was virtually a gas well was converted to an oil producer. Despite immediate results, cementing off the upper gas sands at Rodessa and elsewhere, to leave the lower horizons exposed, does not guarantee permanent relief in contending with gas-cap movement. Remedial work involving a cement process to exclude gas from the flow string is turning noticeably toward provisions for the future by cementing blank pipe through the entire producing interval in order to perforate and re-cement selectively later.

Preventive steps adopted in well completion, as in some of the deep, thin sands of the Gulf Coast area, necessarily entail special use of cement.[10] It is customary in modern high-pressure wells to set and cement the oil string through any upper gas

sands. Here, too, the practice finding recent favor is that of cementing the oil string from the base of the pay section upward with the purpose of selective completion and progressive control of encroaching gas and water.

Circumstantial advantages and disadvantages, ranging from physical adaptability to over-all economy, hazards, and like considerations, are attached to both cement and packer installations, each claiming its own adherents. Any positive shut-off procedure has as its first demand a sound mechanical seal which is proof against channeling in the hole itself. Performance of positive shut-off wells at South Burbank prompts classification into two broad groups: The first reverts conditions to the state of a relatively undepleted reservoir—i.e., to localized division of the pay rejuvenating the lower portion so as to perform in a manner generally similar to a separate formation, with rightful allowance for differences in all fluid and formation properties. The second is in effect a more intricate reservoir not fully protected from highly-gaseous strata above. Hence, the permeability features and production-control relations entailed may become very irregular. There seems to be mutual confirmation between the characteristic elevation trends discussed elsewhere in this paper and the gas-oil ratio characteristics of a reservoir interval flowing below a mechanical shut-off means. The fact should prove generic in its potentialities of application, not only to cementing or any positive exclusion method, but also to other pool cases where gas-cap expansion occurs at high pressures.

Conclusions

Mindful of the basic causes of high gas-oil ratios, and particularly of the importance of reservoir thickness, permeability, and fluid properties, these conclusions have been drawn:

1. Most flowing wells presenting a gas-control problem respond to proper testing by yielding a variety of gas-oil ratios as the rate of production is varied.

2. Selection of the most desirable production rate should be guided by a standard of pool efficiency over protracted periods. Well characteristics change with depletion and sub-surface pressure decline.

3. Production-rate regulation is actually a misnomer for differential-flow pressure adjustment, to an aspect of which all control methods must be reduced. The comparatively new and limited method of preferential acid treatment is included.

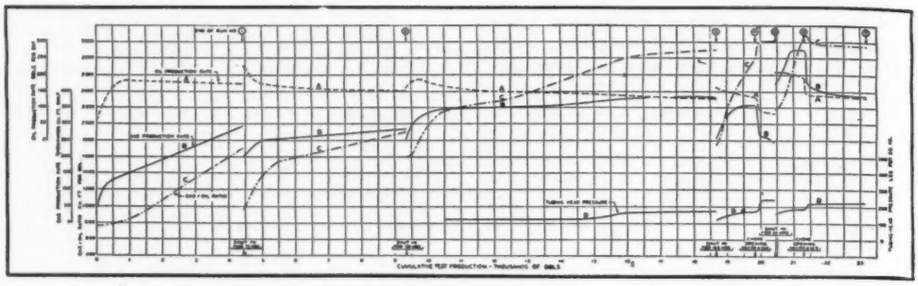
4. The gas-oil ratio control question is primarily one of preventing withdrawal of free gas from the pay formation. With high pressure and large-volume gas conditions, special flow-string equipment can of itself hardly be expected to improve gas-oil ratios.

5. When the desirable utility of other differential regulation methods has been exhausted, the next resort in controlling ratios is to shut off gaseous formations mechanically at the sand face. Where this measure does not eliminate coning action, stopcocking may prove helpful.

6. Continued gas-cap expansion normally influences the permanency of any successful control method, either remedial or preventive. They should, accordingly, be undertaken with an appreciation of future contingencies.

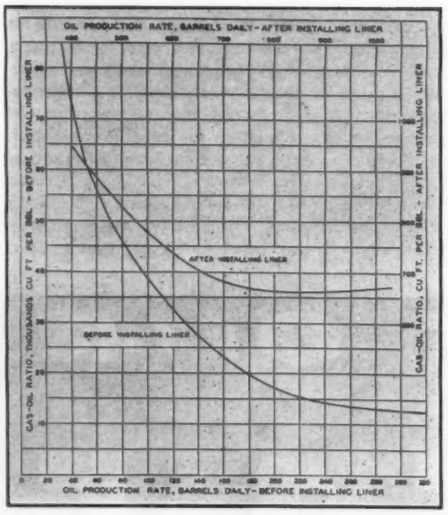
TABLE 6—PRODUCTION CHARACTERISTICS—PACKER-EQUIPPED WELLS, SOUTH BURBANK POOL

	Well "J"	Well "K"
Packer set, minus elevation, ft.	1,740	1,737
Volume of oil to kill well, bbl.	200	300
Volume of oil produced before testing began, bbl.	325	240
Pay sand shut off, ft.	26	25
Pay sand exposed, ft.	49	37
Open-hole optimum ratio	5,470	8,100
Production rate, bbl. per day	336	335
Total production (1st run) bbl. of oil	5,266	4,493
Total production (1st run) M.C.F. of gas	2,556	5,718
Gas-oil ratio (1st run)	380-564	768-1,702
Gas-oil ratio average (1st run)	485	1,272
Term of 1st run, days	36	39
Total production (2nd run) bbl. of oil	3,350	4,850
Total production (2nd run) M.C.F. of gas	1,878	8,199
Gas-oil ratio (2nd run)	300-620	970-1,900
Gas-oil ratio average (2nd run)	561	1,691
Term of 2nd run, days	21	31
Total production (3rd run) bbl. of oil	315	9,339
Total production (3rd run) M.C.F. of gas	235	23,274
Gas-oil ratio (3rd run)	718-786	1,622-3,103
Gas-oil ratio average (3rd run)	746	2,492
Term of 3rd run, days	2	63
Total production (4th run) bbl. of oil	947	1,113
Total production (4th run) M.C.F. of gas	580	2,772
Gas-oil ratio (4th run)	622-685	1,874-2,801
Gas-oil ratio average (4th run)	657	2,383
Term of 4th run, days	7	8
Total production (5th run) bbl. of oil	5,953	614
Total production (5th run) M.C.F. of gas	4,029	1,843
Gas-oil ratio (5th run)	676-754	2,970-3,030
Gas-oil ratio average (5th run)	710	3,002
Term of 5th run, days	44	7
Total production (6th run) bbl. of oil	999	819
Total production (6th run) M.C.F. of gas	607	2,066
Gas-oil ratio (6th run)	500-673	2,267-2,717
Gas-oil ratio average (6th run)	608	2,523
Term of 6th run, days	15	4
Total production (7th run) bbl. of oil	462	1,938
Total production (7th run) M.C.F. of gas	281	5,752
Gas-oil ratio (7th run)	589-662	2,847-3,119
Gas-oil ratio average (7th run)	608	2,968
Term of 7th run, days	2	14
Total production (8th run) bbl. of oil	1,844	.....
Total production (8th run) M.C.F. of gas	1,336	.....
Gas-oil ratio (8th run)	687-779	.....
Gas-oil ratio average (8th run)	725	.....
Term of 8th run, days	14	.....
Accumulated test production, bbl. of oil	10,136	23,216
Accumulated test production, M.C.F. of gas	11,402	49,624
Gas-oil ratio, entire test	380-786	768-3,119
Average gas-oil ratio, entire test	596	2,137
Days elapsed, entire test	141	166



Production Characteristics of Packer-equipped Well—Appreciable Gas-Coning.

Figure 11


OIL PRODUCTION RATE, BARRELS DAILY - AFTER INSTALLING LINER
GAS-OIL RATIO, THOUSANDS CU FT PER BBL. - BEFORE INSTALLING LINER
GAS-OIL RATIO, CU FT. PER BBL. - AFTER INSTALLING LINER
AFTER INSTALLING LINER
BEFORE INSTALLING LINER
OIL PRODUCTION RATE, BARRELS DAILY - BEFORE INSTALLING LINER

Effect of Cementing Blank Liner on Gas-Oil Ratio.

Figure 12

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Kuwait Wildcat

The second wildcat in Kuwait, on the northwestern end of the Persian Gulf, was spudded October 16 by Anglo-Iranian Oil Co. and Gulf Oil Corp., carrying on jointly owned operations as Kuwait Oil Co. The new test is No. 1 Burghan, about 50 miles south of No. 1 Bahran abandoned early this year at 7,950 feet without obtaining commercial showing of oil or gas. The new wildcat is south of Kuwait Bay and the location was selected after companies rechecked their geophysical information.

IMPORTANT BOOKS for the Oil Man

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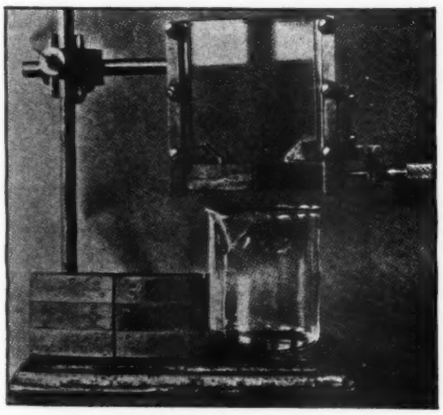
Selection of Screen Openings For Unconsolidated Sands

By C. J. COBERLY
Kobe, Inc., Huntington Park, Calif.

The proper functioning of screen casing is important to the production of oil, as it materially affects the pressure gradient in the immediate vicinity of the well, and it controls the production of sand with the oil. There has been some research and considerable speculation about the shape, size, position, and arrangement of openings in screen and perforated casing; yet little published data on which to base their selection have been available.

Previous Work

At the time the first experimental work reported in this paper was performed (1929-1930) work had been done by E. A. Carr[1a] on the study of core analyses as related to the mesh of wire-wrapped screen casing. Some research had also been conducted by F. G. Tickell at Stanford University, on the bridging action of sand grains of a single classification and of one-to-one mixtures of grains of two classifications. Work on the behavior of core sands in bridging slots had also been performed by F. A. Graser[2] under the direction of Lester C. Uren at the University of California. Most of this work has remained unpublished, so was not and still is not generally available. C. S. Wilson[3] presented an excellent paper on the "Selection and Use of Screen Pipe," covering especially the allowable width of rectangular openings as related to screen analyses of formation samples.



Adjustable slot apparatus, showing interchangeable blocks for different angles of undercut.

Figure 1

The methods of approach and the range of conditions investigated varied considerably. Variation in results as recorded by these observers was probably due to the degree of stability of bridging which each selected as a standard. Also the grain shape and angularity were not recorded or controlled, nor were their effects established. Therefore, a basis for correlation was not worked out.

Outline of Work

The object of the work reported in this paper was to establish an exact analysis of the bridging problem, to correlate such data as were available with this analysis, and to perform additional experiments to extend the range of variables of existing data.

The following division of the subject was determined upon as representing the most logical approach to the general problem:

1. Properties of spheres (steel balls) in bridging openings of various shapes.
   a. Balls of one size.
   b. Mixtures of balls.
2. Properties of classified sand grains in bridging openings of various shapes.
   a. Grains of a single classification.
   b. Mixtures of classifications.

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

3. Properties of formation sands in bridging openings of various shapes.
   a. Unconsolidated sands.
   b. Consolidated sands.
4. Effect of the position, shape, and arrangement of openings.

It was realized early in the investigation of the properties of screen casing that sands, because of the variation in grain shape, were not suitable for an exact investigation of the bridging of openings, even though they were carefully classified as to grain diameter. Spheres were chosen as the "sand grains" of an ideal system, the behavior of which could be determined and duplicated with an exactness that was impossible with sand grains.

Apparatus

The apparatus shown in Fig. 1 was devised to investigate the properties of slotted openings. It was arranged so that the width of openings could be regulated by means of the micrometer screw, and so that the shape of the opening could be altered by inserting different sets of hardened and lapped steel blocks in the base.

For the work on round holes, a 16-leaf iris diaphragm was chosen because of its ready adjustment to different diameters. The approximation to a circular opening was good in the range investigated (0.06 in. to 0.6 in. diameter).

The apparatus shown in Fig. 2 was used in conducting experiments on the effect of slot position and arrangement, and on the effect of pressure on bridge formation and stability. It consists of a square container 3¾-in. inside size, with a 2½-in. round opening in the side and bottom over which plates having various slot openings and arrangements could be bolted. The removable cover was arranged for an oil filler hole, and for connection to a source of constant pressure.

Steel balls were used as the spheres for the ideal system, because they were available in quantity in the proper range for sizes, and with the accuracy and hardness surface finish desired.

Definitions

To facilitate the study of bridging, the following definitions are proposed:

A stable bridge is one which, when disturbed, will reform almost instantly.

The stable opening is the size of opening on which a stable bridge will form. It may be expressed as a dimension or in terms of the size of the bridging medium.

The maximum opening is the size of opening on which a bridge will not form even by blocking the opening from below to permit it to fill with grains under static conditions, and then carefully removing the obstruction. It may be expressed as a dimension or in terms of the size of the bridging medium.

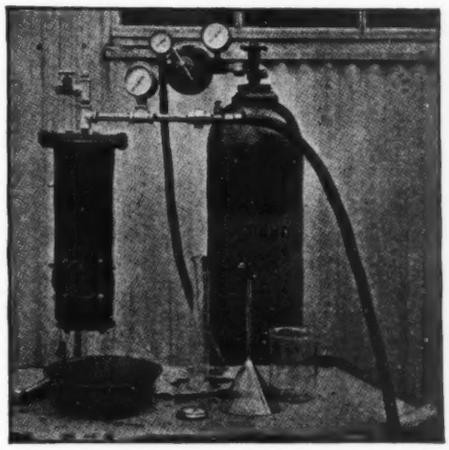
The range of bridging is the ratio of the maximum opening to the stable opening.

The bridging grain size is the diameter of a sphere which would form a bridge on a given slot with a stability equivalent to that formed by a given material on the same slot.

In this paper, whenever grain diameter is referred to, it is taken as equal to the opening in the retaining Tyler screen.

Results of Steel-Ball Tests

The first investigations were made on the bridging of 1/16-in., 3/32-in., and ⅛-in. steel balls on slots of rectangular opening and cross-section.



Apparatus for testing various openings and sands under pressure with oil flowing.

Figure 2

The slot width for stable bridging was found to be two times the diameter of the balls. The upper limit of bridging was found to be at 2½ times the ball diameter. The range of bridging is thus seen to be 1.25.

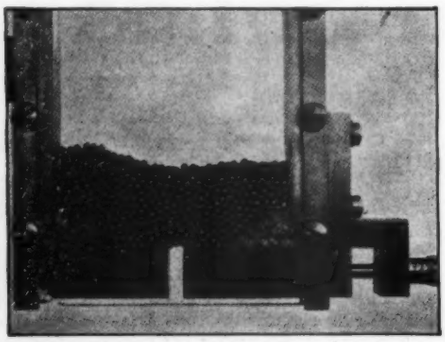
It was noted that two types of bridges formed —a very stable type with a relatively flat "arch" of two or three balls, and a less stable type with a high "arch" across the opening. The type of arch determined the number of balls falling through the opening before a second bridge formed after one had been disturbed. Fig. 3 and 4 illustrate the two types of bridge.

A few experiments using mixtures of two different ball sizes were made. The results are shown

[1a]Figures refer to bibliography.

in Fig. 5. The effect of the large balls in increasing the slot width at which bridging occurs is seen to be considerable as compared to the percentage in the mixture. This is an important factor, as will be brought out later in the discussion on the bridging of formation sands.

It was found that a stable bridge was formed on round holes having a diameter up to three times



Showing bridging of slot 0.1875 inch wide with balls 0.09375-inch diameter. This photograph shows a very flat arch. If the bridge is broken by displacing some of the balls forming the arch, a general movement will be caused. A number of balls will drop through before a bridge again forms.

Figure 3

the diameter of the balls. The maximum hole was found to have 3¼ times the diameter of the balls. The range of bridging is 1.08, which is considerably less than for rectangular slots. (The apparatus may have influenced the results on the maximum hole somewhat, as it was found in the case of the 3/32-in. balls that the upper limit of bridging was on a hole having a diameter of approximately 3.5 times the ball diameter.)

Throughout the tests on slots and round holes it was noticed that, when the slot or hole was larger than that for stable bridging, the action of the balls in rolling into the wedge-shaped valley formed by the withdrawal of balls as they fell through the slot was enough of a disturbance in many cases to cause the balls to flow continuously through the slot. To obtain a representative test, it was necessary to keep the balls remaining in the tester carefully leveled off. This instability due to disturbances behind the slot will be commented on later in connection with grouped slots.

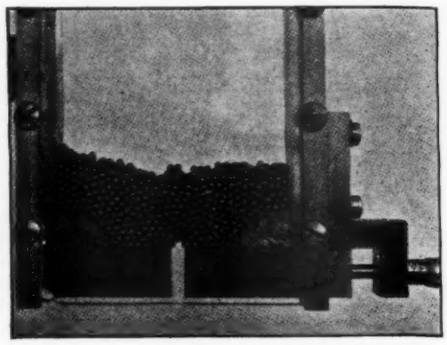
Results With Classified Sand Grains

The work done on steel balls was repeated using classified sand grains in the same testing apparatus. The sand used was a beach sand composed of angular grains with well-rounded edges. The general shape of the grains comprising the sand is shown in the photographs of the slot tester.

Three conditions can be studied with sand grains in the tester—dry sand, sand wet with oil, and sand saturated with oil (oil flowing). Tests of these three conditions with identical sand and slot setting showed that practically the same results were obtained with dry sand and with oil flowing through the tester. Both gasoline and crystal oil were used in obtaining this result. After determining this, all tests were made with dry sand because of the convenience and saving in time. Sand which is wet with oil will bridge a much wider slot. Because of the additional variables involved, and because of its questionable practical value, no further investigation of sand in this condition was made.

Fig. 6 shows the results of bridging tests of classified sands of a single grain size on rectangular slots. Both curves are approximately linear functions. A stable bridge is formed on a slot having a width of approximately twice the grain diameter. The maximum slot was found to have a width of approximately three times the grain diameter. The range of bridging is then 1.5. This is a considerably wider range of bridging than was found when using steel balls. The increase is probably due to the effect of the shape and angularity of the grains.

Slot-bridging tests were also made on binary mixtures of various grains, and the results are shown in Fig. 7. As with the steel balls, the effect of a small percentage of grains of secondary sand



Same as Fig. 3, except in this case a very high arch was formed. With this width of slot, from 2 to 100 dropped through before the bridge was again established.

Figure 4

in increasing the width of slot on which a stable bridge is formed is quite marked. The effect is more pronounced the greater the ratio of diameters between the primary and secondary sands.

The bridging of sand grains on circular holes was investigated, using the same iris as was used for the tests on the bridging of steel balls on round holes. It was found that a stable bridge was formed on circular holes having a diameter of three times the grain diameter, and that the upper limit of bridging was on holes having a diameter as great as 4.5 times the grain diameter. The range of bridging is then 1.5, the same range as was ob-

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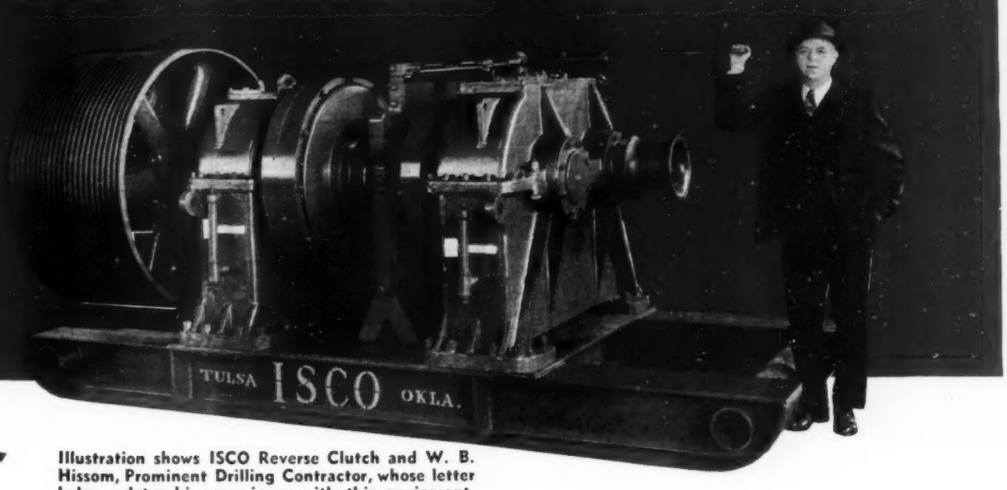

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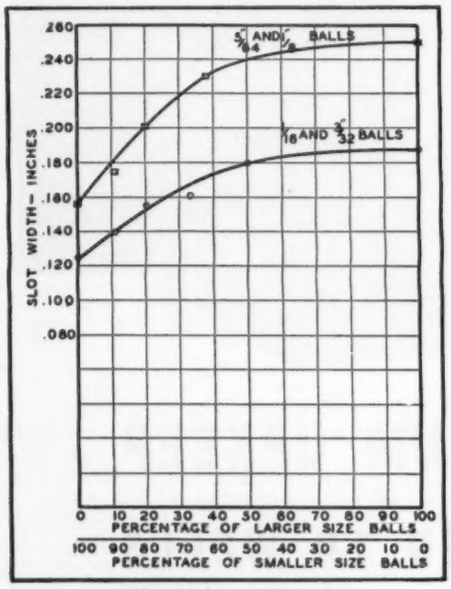
tained for sand grains on rectangular openings. The increase in the range of bridging over similar tests with steel balls can again be attributed to the angularity and shape of the sand grains.

This brings out the fact that the range of bridging will be a function of the particular sand used. It will not be 1.5 for all sands, but will vary with the shape and angularity of the particular sand under investigation.

Formation Sands

The sands from which oil is produced are complex mixtures of grains. The bridging action of



Slot-bridging tests—steel balls.

Figure 5

such sands reduced to ultimate particles depends on the grain size, distribution, shape, and angularity. The effect of the latter two items is generally neglected. The effect of the former two can be obtained from the screen-analysis curve.

The type of screen-analysis curve generally used shows the cumulative percentage by weight held on a given screen as a function of the screen opening plotted on semi-logarithmic paper. The Tyler screen scale is the one most commonly used. This scale is arranged so that the area of the opening in one screen is twice the area of the next smaller screen. This makes the opening of one screen $\sqrt{2}$, or 1.414 times the mesh opening of the next smaller screen.

Most formation sands have a characteristic grading toward the extremes of the grain-size range, with a more uniform grading in the central portion of the range. A few sands show a uniform grading throughout the grain-size range. The point at which this uniformity commences is somewhat uncertain, being determined from a visual examination of the screen-analysis curve. At the coarse end of the curve it generally occurs between the 10 and 20 percentiles. For the purpose of establishing a definite degree of uniformity, it is common to use the portion of the curve between the 40 and 90 percentile as a guide, the quotent of the grain size and the 40 percentile divided by that at the 90 percentile being called the "uniformity coefficient." Its value ranges from 2.5 to 7.5 in ordinary cases, although values as low as 1.5 are found.

Formation sands may occur as ultimate particles, as consolidated sands, as cemented grain groups, or as mixtures of ultimate particles and cemented grain groups. The occurrence of sand in the condition of ultimate particles is rare. There are generally some cemented grain groups occurring with the free sand. Consolidated sands occur in a wide range of compaction, and cementation. The range of crushing strength of such sands varies from practically 0 to 3,000 lb. per sq. in. Cemented grain groups occur either naturally in loosely-consolidated sands, or as a result of breaking down of the face of the formation of consolidated sands. Cemented grain groups may vary in gradation during the life of the well, due to the effect of water or producing conditions. The clearance between the casing and the formation may also affect the character of the material that breaks off the wall and fills this space.

Bridging With Formation Sands

The uniformity of distribution throughout the entire grain-size range probably has some influence on the bridging characteristics of a particular sand. However, the controlling factor is generally to be found in the gradation of the coarse grains in the lower end of the curve. Examination of hundreds of samples in the adjustable slot apparatus, and comparison with their screen analysis, has established the fact that in general the bridging grain size is the grain size at the 10 percentile of the cumulative screen analysis.

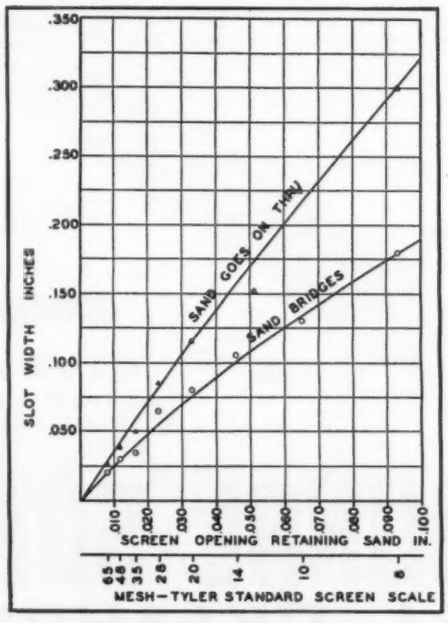
Comparison of Results With Previous Work

F. G. Tickell at Stanford University investigated the screening action of a single undercut slot in a vertical plate. Sand was packed on the narrow side of the slot and arranged so that sections of the sand could be readily examined after each run to check migration of the sand particles.

With a sand of uniform grain size, Tickell found that: "if the slot width was not more than twice the diameter of the grain, no sand would be produced with the oil except with differential pressures of 1,000 lb. per sq. in. and over, when a small amount of sand was passed. With slots wider than the above, all of the sand passed through with the oil at low pressures. With sands of a one-to-one mixture of coarse and fine grains, practically no sand came through with the oil if the slot width was equal to or less than twice the diameter of the coarse grains." The effect of smaller percentages of coarse grains was not considered. This is in direct agreement with results obtained in this work.

Other investigators, notably Carr, Graser, and Wilson, have determined that the critical range for the selection of the mesh of screen casing lies below the 20 percentile.

Carr demonstrated that screen pipe will hold a sand satisfactorily after allowing a small amount of fine sand to pass when the mesh corresponds

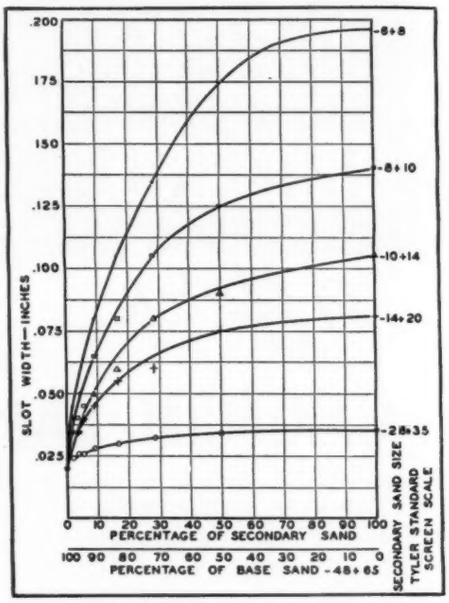


Slot-bridging tests—beach sand.

Figure 6

to the grain size at the 2½ percentile. On plotting the screen analyses of the sands with which Carr worked, the mesh indicated by twice the grain size at the 10 percentile would be 0.013 in. He found a screen of 0.008- to 0.010-in. mesh was satisfactory for this sand. The difference probably lies in the estimation of the amount of sand which is desirable to make before a stable bridge is formed. However, the amount of sand passed before a stable bridge forms must in all cases be such that it will not permanently enlarge the screen openings.

Graser found that a slotted opening would bridge properly if its width is less than twice the



Slot-bridging tests—beach sand.

Figure 7

(Figures 8 to 15 and 22 omitted)

average diameter of the largest one-seventh of the grains banked against it. This result checks very well with that obtained by using twice the screen opening at the 10 percentile.

Wilson takes the critical range as the 5 to 15 percentile and, by a mathematical analysis of the curve between these two points, he establishes the critical grain size which is equal in diameter to the mesh of the screen which will hold the sand under all conditions. From the example he cites, the mesh determined is less than that found by use of the 10-percentile rule.

Effect of Position, Shape, and Arrangement

The effect of the position and arrangement of openings on the stability of bridging were determined. These points were investigated under flow conditions using the pressure apparatus shown in Fig. 2. It has been shown by proper selection of the slot width and thickness in relation to the angle of repose of the sand to be placed behind the slot that a horizontal slot in a vertical plate will hold sand that the same mesh vertical slot in a vertical plate will not hold.

To illustrate the fallacy of this theory under flow conditions, a slot of such a width that dry sand would flow through when the slot was placed vertically, but was held when the slot was placed horizontally, was chosen. A 2-in. sixty-thousandths slot and —28+35 sand were used (ratio of grain to slot 3.7) with crystal oil as the fluid. The sand was placed 2⅝ in. above the center line of slot in both cases. The oil surface was maintained 2⅝ in. above the sand, making a total head of oil of 5 in. In the case of the horizontal slot, the resulting flow was 77.5 cc. per minute, of which 36.5 cc. was sand. In the case of the vertical slot, the total flow was 93 cc. per minute, of which 46 cc.

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was sand. Sand flowed through either slot with only 1/32-in. of oil above the sand.

The following conclusions are drawn from this test:

1. Slots exceeding the maximum opening for a given sand permit the flow of sand as long as

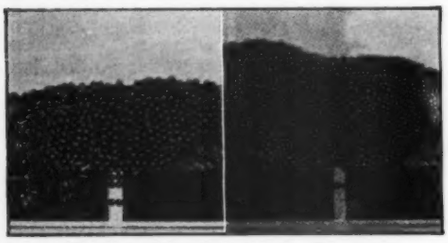

Figure 16 *Figure 17*

Fig. 16—Bridge in slot at width of 0.1870 inch at the top with an undercut of 0.0008 inch. Note that this makes the width almost exactly 0.1875 inch where the lower pair of balls is bridged.

Fig. 17—Bridging in the slot with one-sixteenth inch balls mixed with 10 per cent of three-thirty-seconds inch balls. Slot width is 0.155 inch at the top or 0.00125 inch less than the sum of the diameters. The undercut in this case was 0.0008 inch.

oil is flowing with the slot in either a horizontal or vertical position.

2. Vertical slots of the proper width for the sand are equally as effective as horizontal slots in holding back sand.

Slot width alone controls the bridging effect, the position of the slot being immaterial.

In conducting the slot-bridging tests it was found that there was a tendency to bridge in the slot itself, as illustrated in Fig. 16 to 18. It was first thought that this was due to the slots having a slight amount of negative undercut. However, investigation showed that the slots were parallel, or in some cases slightly undercut. Further experiments showed that the greatest tendency for the slots to fill up occurred when the slot width was from 0.0015 in. to 0.002 in. less than two times the ball diameter, when using balls of one size, or from 0.0015 in. to 0.002 in. less than the sum of the ball diameters when using mixtures of two ball sizes. The undercut in Fig. 18 was 0.0012 in. with undercuts greater than this, it was not possible to make the slot fill with steel balls.

With sand grains, slots having undercuts of 0.0012 in. filled up readily, as shown in Fig. 19. The results of tests with slots having greater undercuts (the amount of undercut being given in degrees) are shown in Fig. 20 and 21. Sand was found to lodge in slots having undercuts up to 2 deg. In a great number of trials no bridge was formed in slots having an undercut of 6 deg.

A series of tests was run in the apparatus shown in Fig. 2 to determine the effect of the arrangement of openings on bridging.

The procedure was to bolt the desired plate in place over the opening in the bottom, place sand to a depth of 5 in. over the plate, fill the container with oil having a viscosity of 70 sec. (Saybolt Universal) at 100 deg. F., bolt the top in place, and apply a pressure of 100 lb. per sq. in. over the oil. Conditions during the ensuing flow were noted.

The following slot arrangements, shown in Fig. 23, were tested:

Plate No. 1—1-in., 6-deg. included angle undercut slot.

Plate No. 2—2-in., 6-deg. included angle undercut slot.

Plate No. 3—1-in., 6-deg. through group of 3 slots, 13/64-in. bar between slots.

Plate No. 4—2-in., 6-deg. through group of 3 slots, 13/64-in. bar between slots.

Plate No. 5—continuous-grid, $\frac{5}{16}$-in. square bars, 0.100 in. apart.

Plate No. 6—wire-screen, 8-mesh, 0.096-in. openings.

Plate No. 7—1 No. 39 hole (0.0995-in. diameter).

Plate No. 8—group of 13 No. 39 holes (0.0995-in. diameter).

A single 1-in. slot with 6-deg. undercut was used as the standard of comparison.

When plates No. 5 and 6 were used, the 2½-in. diameter of the side or bottom opening determined the amount of the grid or screen exposed to the sand. With the grid in place, 17¾ in. of slot was exposed.

The plate shown at the right of the top row of Fig. 23 was bolted under plates No. 3 and 4, and a run made with this plate in position for each slot width tested. The chamfered side of this plate was placed against the slotted plate.

The slot width in plates No. 1 to 4 was varied from 0.040 in. to 0.120 in. by 0.020-in. steps. Results of the test were as follows:

With single 1-in. and 2-in. slots the stable slot width was 0.080 in. and the maximum was 0.120 in., and with groups of 1-in. and 2-in. slots the

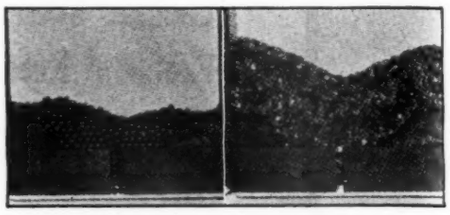

Figure 18 *Figure 19*

Fig. 18—Bridging in the slot with three-thirty-seconds inch balls. Slot width at top 0.1847 inch. Undercut 0.0012 inch. With greater undercut than this, steel balls could not be made to bridge in the slot.

Fig. 19.—Bridging in slot with sand grain — 10 + 14. Undercut 0.0012 inch. Slot width 0.090 inch at top.

stable slot width was 0.080 in. and the maximum slot width was 0.100 in.

The maximum slot width with the plate backing the slots was 0.120 in., but with wider than

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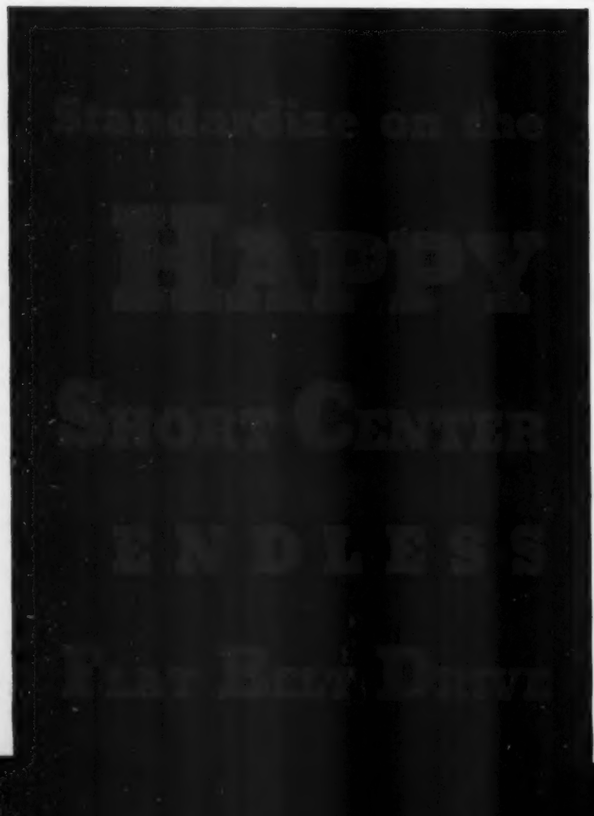

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0.080 in. the slots filled completely with sand except opposite the hole.

With the grid in place, too much sand was made before a bridge formed. This was to be expected after the results obtained with the groups of slots.

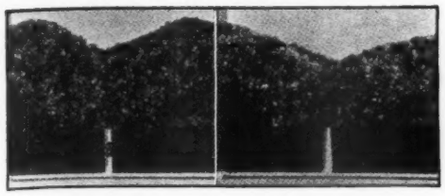


Figure 20 *Figure 21*

Fig. 20—Bridging in slot with —10 + 14 sand. Slot width 0.090 inch at top. Under 2-deg. Included angle. Bridge did not form readily with this undercut.

Fig. 21—Showing slot 0.090 inch wide at top with undercut of 6-deg. Included angle. No bridge was formed in the slot with this undercut in a great number of trials.

Sixteen times as much sand was made as was made by the single 1-in. slot.

With the screen, only about one-half as much sand was made as was made by the grid. However, approximately eight times as much sand was made before bridging occurred as was produced through a single 1-in. slot of 0.100-in. width.

Plates No. 7 and 8 produced a stable bridge.

The instability of the group slots parallels the observations made on the instability of the bridging of steel balls due to the continual re-arrangement of the balls above the slot. These tests show that it is important that the spacing of slots should be such that a disturbance in the bridge on one slot will not break up the bridge on an adjacent slot. The minimum slot spacing at which proper bridging action takes place was not determined.

The rules determined from tests reported in this paper apply to unconsolidated sands, and may apply to broken or semi-consolidated sands if representative samples can be obtained. With consolidated sands the slot width as determined by ultimate grain size of the formation are much narrower than those found by field experience.

A study of the degree of consolidation perhaps by means of compression tests of core samples, with the load applied both parallel and perpendicular to the bedding planes, will offer a means of correlating with field results. It is suggested that this property of the core sample be recorded along with the porosity and permeability to facilitate this study.

Conclusions

Spherical grains form stable bridges on openings larger than the diameter of the grain, the ratio being two for rectangular openings and three for circular openings.

Grain angularity and shape do not materially affect the opening size for a stable bridge, but do increase the "range of bridging."

In mixtures of two grain sizes of either pherical or angular grains, the bridging influence of the larger grain is great in relation to the amount present.

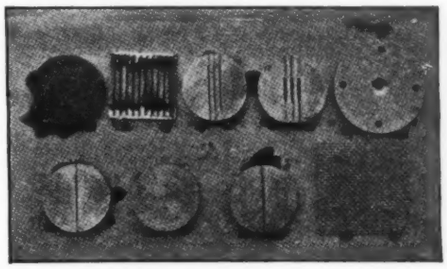
Stable bridging of typical unconsolidated oil sands occurs when the opening in the screen which retains 10 per cent of the sample is taken as the diameter of the "bridging grain" and the rules for spherical grains applied.

The angle of repose of sand cannot be relied upon to produce bridging if the sand is saturated with fluid; hence, the position of slots does not affect bridging.

Undercut in excess of 2-deg. included angle is necessary to avoid clogging of the screen opening. It is desirable to avoid close spacing of slots, as it reduces the "range of bridging."

The results obtained are in reasonable agreement with those of other investigators.

The widest stable slot for broken consolidated formations can be determined from bailer samples, but cannot be relied upon because of the possible effect of water or producing conditions on the cemented grains.



Different types of openings tested in apparatus shown in Fig. 2.

Figure 23

The widest stable slot for well-consolidated sands cannot be determined by the methods outlined in this paper.

Acknowledgment

The author wishes to acknowledge the assistance of Mr. E. M. Wagner in the preparation of this paper.

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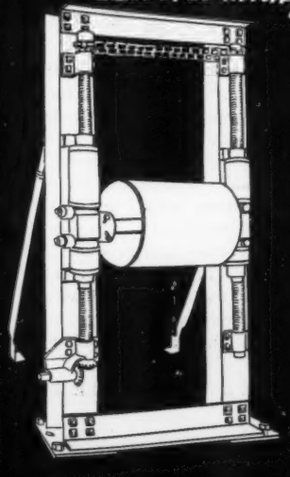

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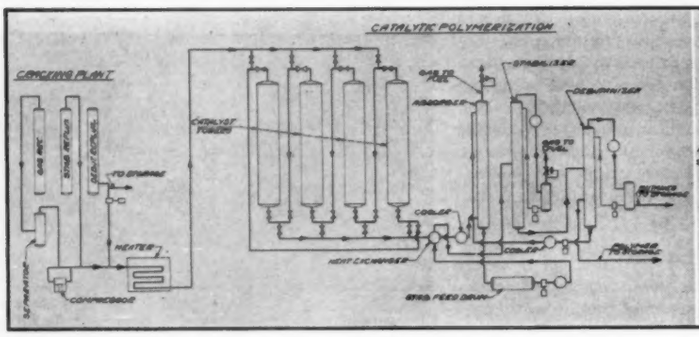


Figure 1

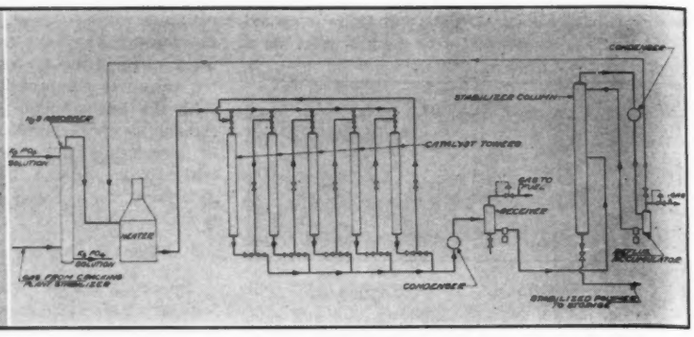


Figure 2

Motor Fuels From POLYMERIZATION

By GUSTAV EGLOFF, J. C. MORRELL and EDWIN F. NELSON
Universal Oil Products Co.

The polymerization process is one of the most important developments in the petroleum refining industry. Motor fuel was first produced by straight distillation, and later by cracking. The quantity of gas produced in the cracking process increases with the improvement of the antiknock quality of the motor fuel product, and a satisfactory economic disposal of this gas was a real problem. This was solved by the introduction of the polymerization process with the production of a superior motor fuel from the gas. The cracking process depends for its economic utility on the conversion of heavier hydrocarbons to lighter ones of greater value, while the polymerization process is in principle the reverse, namely the conversion of gaseous hydrocarbons to liquid ones in the form of high antiknock motor fuel.

Over 9,000,000,000 gallons of polymer gasoline may be produced yearly from hydrocarbon gases produced in the United States, of which over 1,000,000,000 gallons may be isooctane fuel of 95 to 100 octane rating. The principal economic goal of the polymerization process was the conversion of these gases used primarily for heating purposes into motor fuel. The objective was not only attained but the product was found to be a super type.

The demands of the automobile and aircraft industries for high octane fuel have been increased from year to year and polymerization in its various modifications and aspects, including selective polymerization for the production of isooctanes, has met these demands. Since 1925 the maximum automobile speed has increased from 60 to over 100 miles per hour and the cruising speed of airplanes from 80 to 220 miles per hour, and this has been made possible primarily by high octane motor fuels.

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

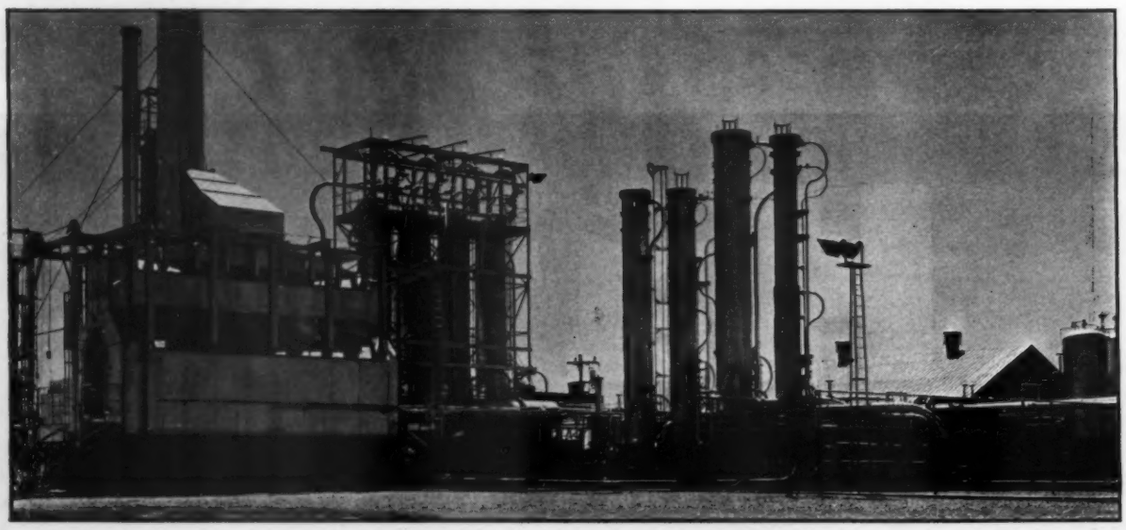
The requirements of automobiles may generally be satisfied by fuels of a value less than 75 octane. For airplanes, however, fuels of 95 to 100 octane are desirable and for military purposes are necessary. The Army and Navy have practically set a standard of 100 octane fuel for their own use and will require from 50,000,000 to 60,000,000 gallons for the current year. The diplomacy of European and Far-Eastern countries is built up around petroleum, the most important strategic product of which is 100 octane aviation fuel.

The power output and load-carrying capacity of a given airplane has been increased. When using a 100 octane fuel an increase in power of from 20 to 30 per cent over that of an 87 octane fuel was obtained.

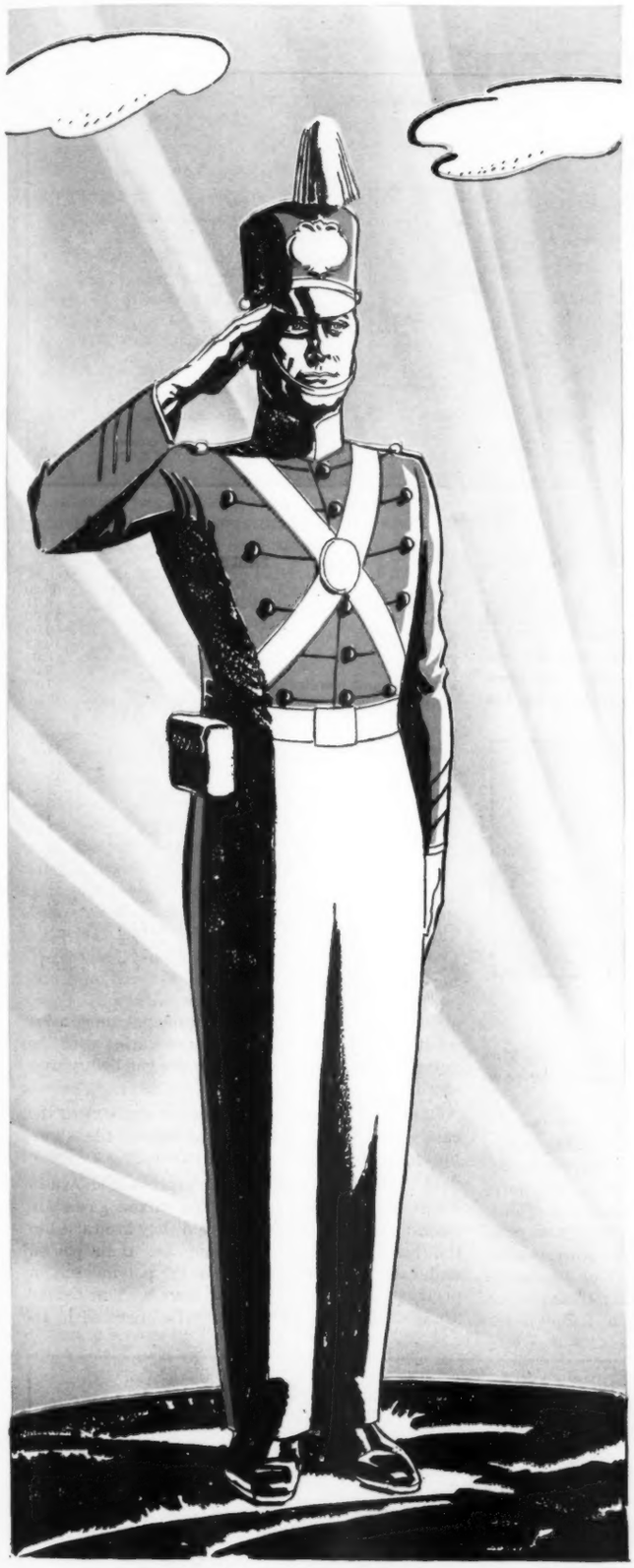
Polymerization has pointed the way and is a definite advance in chemical control of the composition and properties of motor fuels. The day has arrived when a motor fuel may be designed and produced commercially as branch chain paraffins such as isooctanes, or mixtures of isooctanes, isopentanes and isohexanes.

For many years it has been the goal of chemists in the petroleum industry to employ petroleum as a raw material for the production of chemical derivatives of petroleum hydrocarbons for use in the various arts and industries. This goal is now a reality because of the development of the cracking process whereby the olefins contained in the gases produced therefrom may be converted into a large number of products including alcohols, glycols, alcohol-ethers, ethers, oxides, aldehydes, ketones, esters, acids, anhydrides, chlorinated compounds, amines, and products useful in the arts as explosives, dyes, medicinals and the like.

The catalytic polymeri-



Butane cracking and catalytic polymerization unit



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zation process represents one of the most important steps in the production of these chemical derivatives in addition to providing a chemical means for the petroleum technologist to produce motor fuels, such as isooctanes, having definite composition and properties.

In the present report three modifications of catalytic polymerization will be described. All of them employ the so-called solid phosphoric acid catalyst developed by Dr. V. N. Ipatieff.

One of the simplest means of utilizing the catalytic polymerization process is to treat gases containing propene and butenes. In the first modification to be described in this paper, the charging material consists of hydrocarbon gases containing propene and butenes. In the second modification, known as the selective polymerization process, the olefins contained in the hydrocarbon gases are principally butenes. In the third process to be described, the paraffin hydrocarbons such as butanes are converted by pyrolysis into olefin hydrocarbons which are subsequently converted into motor fuel by catalytic polymerization.

Catalytic Polymerization

A catalytic polymerization unit in commercial operation treating 14,000,000 cubic feet of cracked gas a day containing 25.4 per cent of propene and butenes is producing at the daily rate of 68,000 gallons of 82-octane motor fuel of 9-10 pounds Reid vapor pressure.

The gas to be treated is obtained from the stabilizer and the debutanizer of the cracking unit and may, if desired, include the gas from the receiver.

The typical analysis of the gas leaving the cracking plant receiver is shown in Table 1.

The unstabilized gasoline produced in the cracking process is pumped to a stabilizer operated at a pressure of 350 pounds to produce propane-propene free bottoms. In this operation part of the butane-butene fraction is taken over at times.

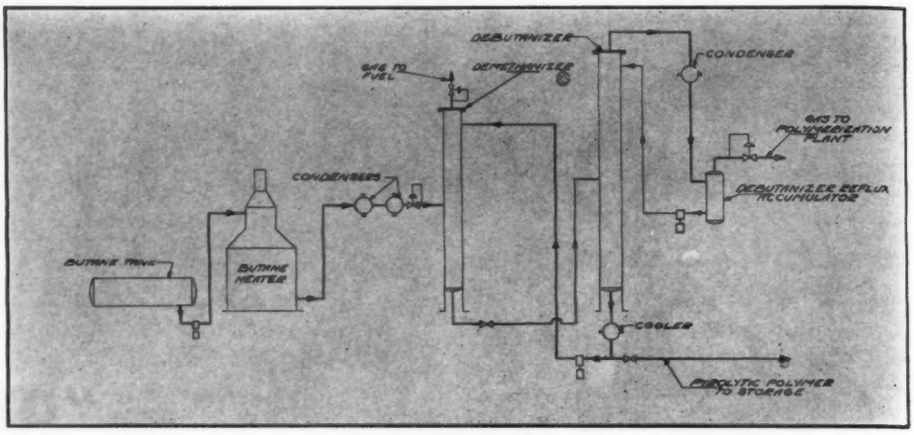


Figure 3

An analysis of the gas from the stabilizer is shown in Table 2.

The gasoline from the stabilizer may go direct to storage or may pass to a debutanizer operated at a pressure of about 100 pounds, wherein the cracked gasoline is stabilized to a low vapor pressure. This vapor pressure is determined by the over-all yearly butane balance of the plant. The butane-butene fraction may go to storage or part to the polymerization unit.

Various proportions of the gases from the cracking unit obtained as described are charged to the polymerization unit at a pressure of approximately 300 pounds. The combined charge to the polymerization unit is heated to a temperature of 375-400° F. and is passed through the catalyst towers in series flow. The towers are packed with the solid granular phosphoric acid catalyst which has a definite size and shape. When passing through the catalyst towers, the gases increase in temperature about 150° F. due to the exothermic polymerization reaction. The rise in temperature varies with the percentage of higher olefins in the gas being processed.

Analyses of hydrocarbon gases charged to the catalytic polymerization unit at various times during the operation are shown in Table 3.

A typical flow sheet of this process is shown in Figure 1 and photograph. The mixed gases are passed through a heater wherein they are raised to the reaction temperature and are then passed under the operating pressure of the polymerization process through the catalyst towers. The towers are arranged so that they may be operated in se-

TABLE 1

	Mol. %
Methane	58.20
Ethylene	6.71
Ethane	13.09
Propylene	6.05
Propane	10.62
Butylene	2.06
Butanes	2.08
Pentanes and heavier	1.19

TABLE 2

	Mol. %
Methane	11.01
Ethylene	5.98
Ethane	19.10
Propylene	18.38
Propane	35.67
Butylenes	4.89
Butanes	4.97

TABLE 3

	(1) Mol. %	(2) Mol. %	(3) Mol. %
Methane	13.9	24.1	32.3
Ethane and ethylene	21.7	24.6	23.3
Propene	15.4	12.8	12.8
Propane	32.5	25.0	20.2
Butenes	8.5	6.2	5.4
Butanes	8.0	7.3	6.0

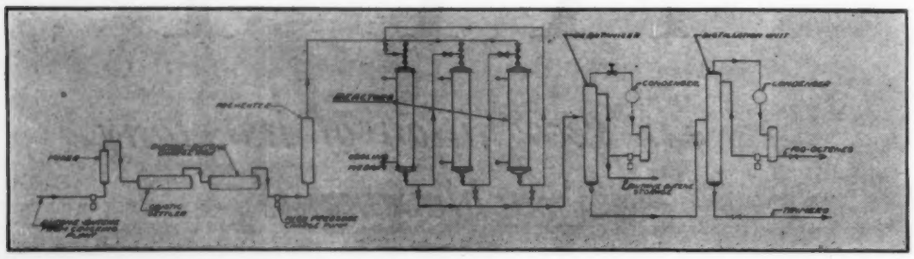


Figure 4

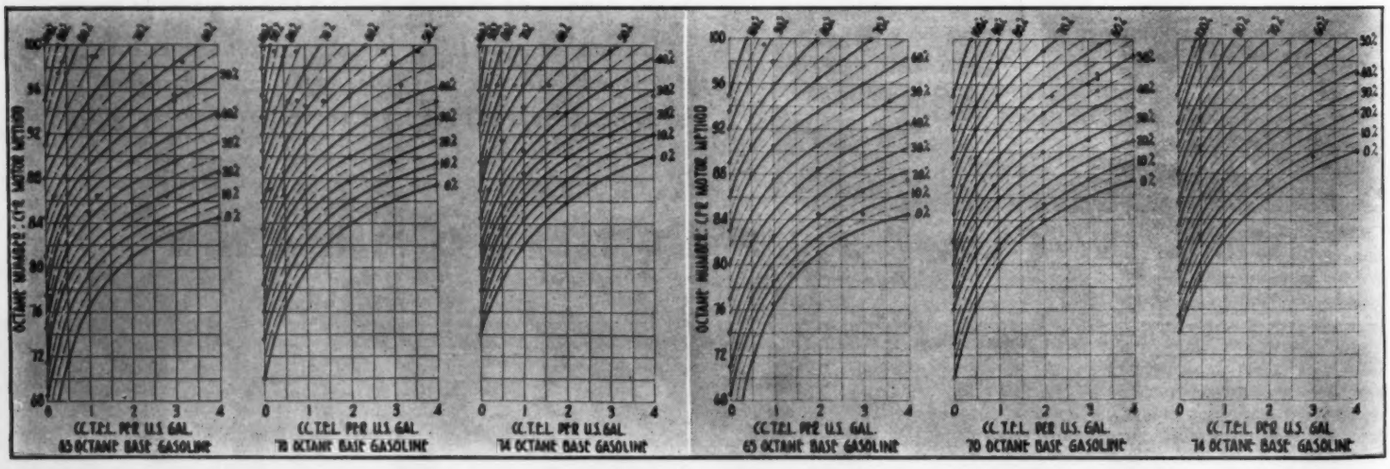


Fig. 5 — Isooctane (commercial 100 octane number) blended with straightrun base gasolines of 65, 70 and 74 octane number

Fig. 6 — Isooctane (commercial 95 octane number) blended with straightrun base gasolines of 65, 70 and 74 octane number

quence and so that any one may be cut out for regeneration.

The polymer product together with residual gas passes through heat exchangers and coolers into an absorption column operated at a pressure of 225 pounds employing the low vapor pressure fraction of the polymer as an absorption oil. The liquid product from the absorber passes to a stabilizer feed drum and the residual gas goes to the fuel system. The liquid in the stabilizer feed drum is heat exchanged with the products leaving the catalyst tower and is then fed into the stabilizer, the gases from which are passed to the fuel system or may be recirculated back to the catalyst towers. The overhead from the stabilizer contains propane-propene and lighter gases. The liquid product from the stabilizer flows to the debutanizer operating at 100 pounds pressure wherein the C_4 fraction containing about 13 per cent butenes are removed and sent to storage. The polymer product is removed as a side cut from the debutanizer and sent to storage and the low vapor pressure polymer from the bottom of this column is recirculated as absorption oil.

TABLE 4

	(1) Mol. %	(2) Mol. %	(3) Mol. %
C_1	33.2	42.6	55.6
C_2	42.3	33.6	28.5
C_3	22.9	22.2	15.1
C_4	1.6	1.6	0.8
Per cent propene and butenes	3.3	5.0	2.8

TABLE 5

	Mol. %
Methane	4.4
Ethane and ethylene	27.4
Propene	7.0
Propane	61.0
C_{4+}	0.2

As the run progresses, the order in which the catalyst towers are used is changed. During the operation the catalyst becomes covered with a carbonaceous deposit which reduces its catalytic activity and which must be removed periodically. The tower containing the catalyst which has become inactive is cut out of the system and the catalyst regenerated by controlled oxidation. After burning, a steam treatment is used to rehydrate the catalyst which otherwise would be inactive. The catalyst in each tower is reactivated after being in service about 60 days.

From the operation to date, a total polymer production equivalent to about 50 gallons per pound of catalyst has been obtained without any apparent appreciable change in the activity of the catalyst.

Typical analyses of the gas leaving the absorption column at various times during the operation is shown in Table 4.

An analysis of the stabilizer gas (depropanizer) to the fuel system is shown in Table 5.

The polymer product of the process has a Reid vapor pressure of 2-3 pounds and other properties shown in the analysis in Table 6.

The polymer may be sweetened and blended directly with gasoline or may be redistilled if a water white product is desired.

When the product is redistilled, doctor sweetened, and blended with butanes to desired vapor pressure, the analysis is as shown in Table 7.

A typical daily operating summary showing quantities charged, and yields of products is shown in Tables 8 and 9. Table 8 shows the results of catalytic processing of cracked gas containing 19.2 per cent propene-butenes and Table 9 shows the treatment of 25.4 per cent propene-butenes containing gas.

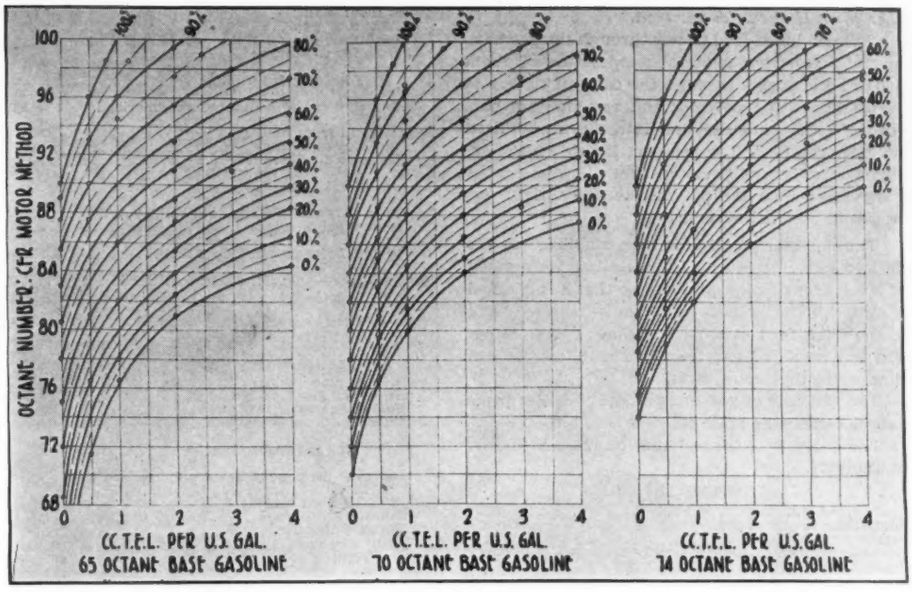


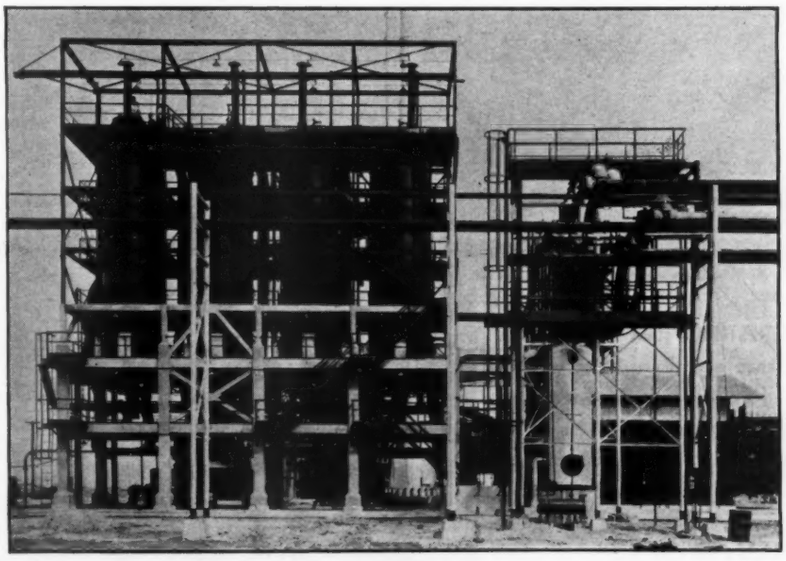
Fig. 7—Isooctane (90 octane number, commercial) blended with straightrun base gasolines of 65, 70 and 74 octane number

TABLE 6

Gravity, °A.P.I.	62.2
I.B.P., °F.	162
10 per cent	189
20	197
50	226
80	290
90	332
E.P.	435
Per cent rec.	98.5
Per cent res.	1.0
Per cent loss	0.5
Reid vapor pressure, lbs.	2.7
Octane number	82.0

TABLE 7

Gravity, °A.P.I.	67.1
I.B.P., °F.	95
10 per cent	156
20	186
30	200
40	212
50	221
60	233
70	250
80	280
90	329
E.P.	376
Per cent rec.	95.5
Per cent residue	0.5
Per cent loss	4.0
Reid vapor pressure, lbs.	10.8
Color	30
Doctor	O.K.
Corrosion	O.K.
Induction period (minutes)	135
Copper dish gum	6
Sulfur, per cent	0.199
Octane number	82.0



Catalytic polymerization unit

In another commercial installation shown in Figure 2, the gas for polymerization is taken from the cracked gasoline stabilizer at a pressure of about 190 pounds and a temperature of 135° F. The gas from the stabilizer contains from 35 to 40 per cent of propene and butenes. The hydrogen sulfide content is relatively high and contains from 2 to 2.5 per cent hydrogen sulfide. If the gas containing hydrogen sulfide is passed through the catalytic polymerization unit, the gasoline formed would contain about 2 per cent sulfur mostly of the mercaptan type which would be formed during the reaction. Doctor sweetening the polymer gasoline would be somewhat difficult and there would be a loss in octane number during the sweetening operation.

The removal of hydrogen sulfide is accomplished by passing the gas which is available at about 190 pounds pressure and 135° F. temperature, through an absorber column. The absorber column is operated at a pressure of 180 pounds and temperature of about 145° F. Under these conditions no condensation of the heavy hydrocarbons in the gas will take place.

The gas enters the bottom of the absorber and tri-potassium phosphate solution is pumped into the top of the column. The tri-potassium phosphate solution is regenerated and circulated. The gas leaving the top of the absorber has a hydrogen sulfide content of the order of 0.10 per cent.

The polymerization unit was designed to process 2,500,000 cubic feet of gas per day. At the present time there is about 1,500,000 cubic feet per day of gas available in this refinery for polymerization which contains about 40 per cent higher olefins.

For the best operation of the polymerization unit, gas from the polymer stabilizer is recycled through the catalyst towers along with the fresh

feed so there is a charge of about 2,500,000 cubic feet per day through the poly unit. The propene-butene content of the combined charge to the polymer plant is about 29 per cent.

The combined feed passes through the gas heater and enters first tower at temperature of about 400° F. and passes through the catalyst towers in series flow. The polymer and residuel gas pass through the condenser and into the unstabilized polymer receiver. The pressure is held on the entire system by the pressure control valve on the gas release from the polymer receiver. This gas passes to the fuel system.

The polymer gasoline is then stabilized to the desired vapor pressure. The stabilizer is operated at a sufficiently high pressure so that a controlled quantity of the stabilizer gas can be charged back to the fresh feed as recycle without compressing. The net make of gas from the stabilizer is discharged to the fuel system.

The amounts of gas charged and yields of products are shown in Table 10.

The analysis of the polymer gasoline is shown in Table 11.

TABLE 11

Gravity, °A.P.I.	68.3
Reid vapor pressure, lbs.	9.8
Octane number	82.2
Mercaptan sulfur	0.025
Cu. dish gum. mg./100 cc.	5
I.B.P., °F.	87
10 per cent	132
50	209
90	325
E.P.	403
Rec., per cent	96.5
Residue, per cent	0.5
Loss, per cent	3.0

Butane Cracking and Catalytic Polymerization

A combination gas cracking and catalytic polymerization unit for the conversion of butanes and polymerization of the olefins produced is in commercial operation processing 1,090 bbls. a day of butane. The butane cracking at high temperature and pressure produces relatively large yields of olefin containing gases and relatively small amounts of pyrolytic gasoline. The cracked gases are polymerized catalytically as already described.

Referring to Figure 3 and Photos 2 and 3, butanes from the charge tank are pumped through a heater which operates at a pressure of about 750 pounds and a transfer temperature at 1,065-1,075° F. Sufficient soaking time is provided in the heater to produce the desired conversion of about 50 per per cent of the charge.

The transfer material is cooled to about 90° F. under full plant pressure and is released into the demethanizer column which operates at 300 pounds pressure.

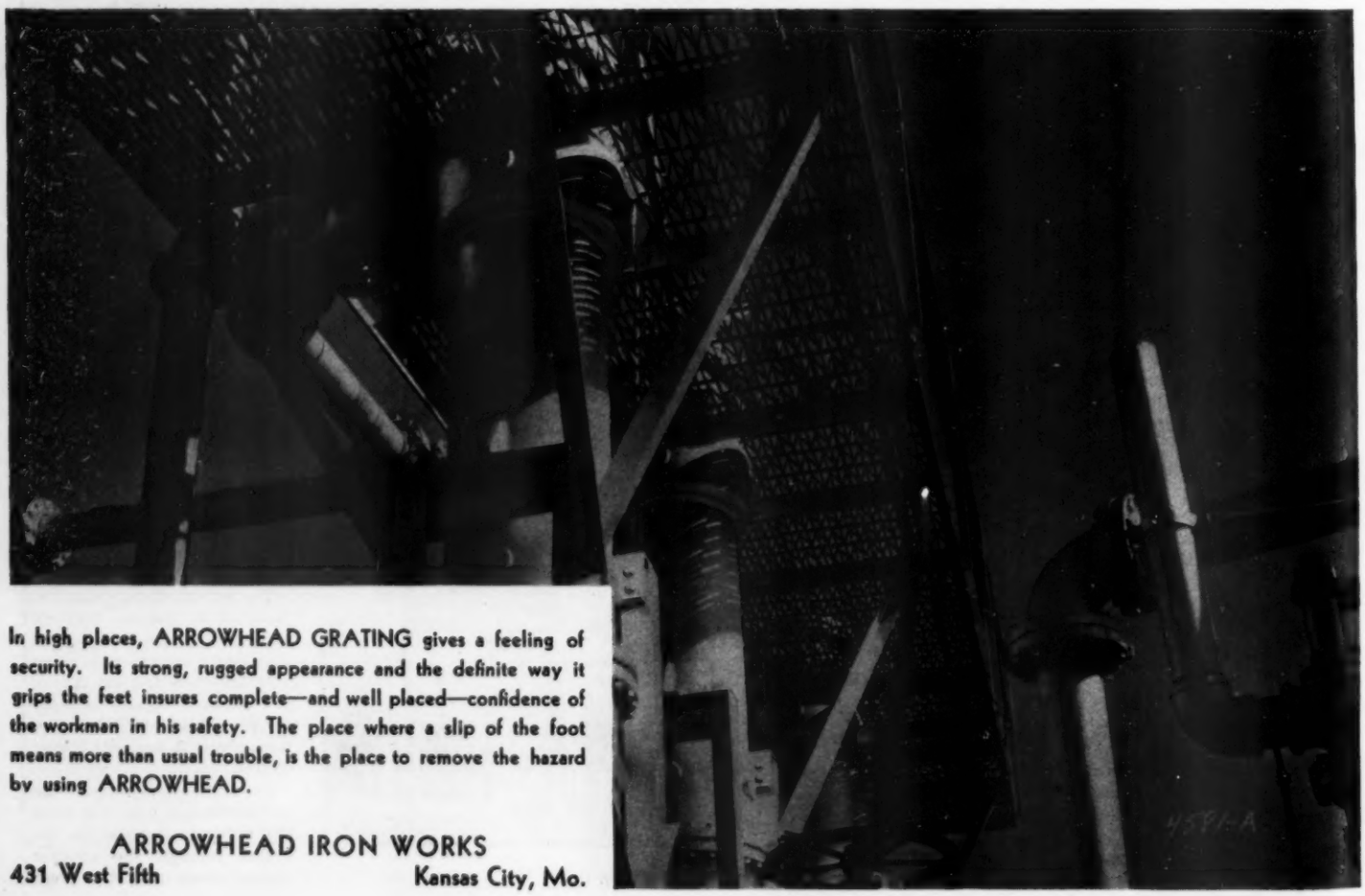
In this column substantially all of the methane

TABLE 8

	M. cu. ft.	Bbls.	Propene-butenes (%)
Total feed to plant	13,070		19.2
Gases from plant:			
Absorber gas	6.700		
Stabilizer gas	2.900		
Butanes to storage	1,350		
Total gas from plant	10,950		4.3
Per cent propene-butenes polymerized		79.5	
Liquid yield from plant:			
Butanes to storage		914	
Butanes to blend		60	
Total butanes		974	
True polymer (2-3 lb. Reid V.P.)		1,082	
Rerun polymer		1,073	
Rerun bottoms		9	
True polymer—gals./M. cu. ft. total feed			3.48

TABLE 9

	M. cu. ft.	Bbls.	Propene-butenes (%)
Total feed to plant	13,874		25.4
Gases from plant:			
Absorber gas	5,062		
Stabilizer gas	4,032		
Butanes	1,624		
Total gas from plant	10,718		4.6
Per cent propene-butenes polymerized		86.5	
Liquid yield from plant:			
Butanes to storage		1,064	
Butanes to blend		88	
Total butanes		1,152	
True polymer (2-3 lb. Reid V.P.)		1,474	
Rerun polymer		1,464	
Rerun bottoms		10	
True polymer—gals./M. cu. ft. total feed			4.47



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and part of the ethane and ethylene are removed overhead and the remaining components are removed as bottom product. This separation is accomplished by using debutanized pyrolytic polymer as absorption oil in the top of the column and partially stripping the liquid in the bottom of the column through reboiling.

The bottom product from the demethanizer is discharged into the debutanizer column. This column is operated at sufficiently high pressure so that the overhead gases may be satisfactorily processed in a catalytic polymerization plant. These overhead gases which include all of the butane-butenes and lighter hydrocarbons produced during the cracking reaction with the exception of those discarded from the demethanizer column contain from 25 to 28 per cent of propene-butenes.

A debutanized pyrolytic polymer is removed from the bottom of the column. Part is recirculated to the demethanizer column as absorption oil and the remainder passes to storage.

The polymerization unit is of the same type already described. It is followed by conventional fractionation equipment for the separation of catalytic polymer of the desired vapor pressure, and residual butane.

It has been found advantageous to remove hydrogen sulfide from the butane before charging to the unit since this results in the production of doctor sweet products.

In a typical operation the butane fraction from the natural gasoline plant used as charging stock for the cracking-catalytic polymerization unit, showed the analysis in Table 12.

TABLE 12

	Mol. %
Propane	3.3
n-Butane	83.2
i-Butane	12.2
Pentane	1.3

This charging stock at the rate of 1,090 bbls. per day was heated to a temperature of 1,065° F. and 750 pounds pressure in the cracking unit, from which 109 bbls. per day of pyrolytic polymer gasoline of 4.7 Reid vapor pressure was produced, having additional properties shown in Table 13.

TABLE 13—PYROLYTIC POLYMER GASOLINE

A.P.I. gravity	48.5
A.S.T.M. distillation:	
Sulfur, per cent	0.22
B.P., °F.	119
Per cent distilled over:	°F.
10	147
20	159
50	202
90	407
Endpoint	520
Vapor pressure (Reid), lbs.	4.7
Octane No. (C.F.R.M.)	74

The hydrocarbon gases from the debutanizer of the butane cracking unit were analyzed for their propene and butene content, which showed 27.7 per cent. This gas was passed through the catalytic polymer gasoline unit, producing at the rate of 293 bbls. per day based upon the original 1,090 bbls. butane processed. The analysis of the polymer gasoline produced is shown in Table 14.

TABLE 14—CATALYTIC POLYMER GASOLINE

A.P.I. gravity	67.9
Sulfur, per cent	0.01
Gum (A.S.T.M.), mgs.	12.3
Copper dish, mgs.	81
A.S.T.M. distillation:	
B.P., °F.	95
Per cent distilliated:	°F.
10	134
20	157
50	209
90	333
Endpoint	430
Vapor pressure (Reid), lbs.	8.3
Octane No. (C.F.R.M.)	81

Selective Polymerization and Isooctane Motor Fuel

The catalytic production of isooctenes from the normal and isobutene present in cracked gases is being carried out commercially under relatively mild conditions. The isooctenes produced are hydrogenated into isooctanes of values ranging from 90 to about 100 octane. The octane ratings can be controlled as a function of the percentage of normal and isobutene present in the charge and the time, temperature, pressure conditions. The higher the octane rating, the lower the yield of isooctanes per barrel of butane-butene processed.

TABLE 10

	M. cu. ft./day	Propene-butenes (%)
Fresh feed to plant	1,483	37.9
Poly stab. gas	901	15.0
Combined charge to plant	2,384	28.9
Gases from plant:		
Poly receiver gas	753	3.4
Stabilizer reflux accumulator gas	231	15.0
Total gases from plant	984	6.1
Per cent propene-butenes polymerized		89
Total polymer produced, bbls.		250.5
Polymer produced, gals./M. cu. ft. total feed		7.1

The process of producing isooctanes by the catalytic polymerization reaction uses as a charging stock the butane-butene (B.B.) fraction from the stabilizer producing the vapor pressure cracked gasoline desired. The B.B. fraction contains 15 per cent of isobutene, 30 per cent of normal butene and 55 per cent of normal and isobutanes. A flow chart of the isooctane process is shown in Figure 4.

The butane-butene charge is passed through a caustic soda scrubber to remove the sulfur components present. The liquefied hydrocarbon gas is then pumped through a heating coil wherein the temperature is raised to about 350° F. under a pressure of about 600 pounds. The B.B. fraction then passes through a "solid phosphoric acid" cat-

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alyst wherein the exothermic heat of the reaction is controlled by a cooling fluid, such as oil around the reaction tubes, and the desired temperature is maintained during the polymerization. Dependent upon the time-temperature-pressure conditions prevailing and the percentage of normal to isobutane present in the charge, their combination takes place in varying proportions.

The polymer product is then passed to a tower where it is stabilized, after which it is fractionated into the isooctenes (dimers) and dodecenes (trimers). In general, the percentage of isooctenes in the polymer product is about 85 per cent, the balance being trimers. The polymer product produced is 30 per cent of the butanes-butenes fraction charged to the unit. This is when producing isooctenes (85 octane) on the basis of a charge of 1:1 ratio of normal to isobutene. The isooctene fraction which boils between 200° F. and 260° F. is hydrogenated to isooctanes of 96 octane rating. The commercial unit described has a daily capacity of 1,300 bbls. of butane-butene fraction producing therefrom 347 bbls. of isooctenes and 34 bbls. of trimers. The isooctenes are converted into isooctanes by catalytic hydrogenation.

Blending of Isooctanes

The isooctanes being produced commercially have a boiling range of 200-260° F. and therefore are not a complete motor fuel as to volatility. They require blending with hydrocarbons such as those of aviation gasoline boiling range or isopentane, or isohexanes, in order to give volatility to the fuel. The blending values of 90, 95 and 100 isooctane fuels mixed with varying percentages of 65, 70 and 74 octane gasolines or isopentane (90 octane) and then adding tetraethyl lead to produce a 100-octane fuel, are given in Figures 5, 6 and 7.

In some cases isopentane is blended with isooctane and straightrun gasoline in order to provide the required front end volatility to the isooctane. The volume of isopentane is generally restricted to about 15 per cent. The results of blending 100 isooctane fuel, 74 octane aviation straightrun of 7 pounds Reid vapor pressure, and isopentane with 3 ccs. of lead to produce 100 octane are shown in Table 15.

TABLE 15—COMPOSITION OF 100-OCTANE FUEL CONTAINING 3 CC. T.E.L./GAL.

Per cent isopentane—	Per cent aviation gasoline	Per cent isooctane	Reid vapor pressure lb./sq.in. at 100° F
0	38.0	62.0	4.0
10	37.2	52.8	5.8
17	36.7	46.3	7.0
20	36.4	43.6	7.7
30	35.7	34.3	9.5
40	34.9	25.1	11.4
50	34.1	15.9	13.3

The importance of isooctane in aviation fuel has been established for special uses such as military aviation and high-revenue transport. One may readily predict that within a short time all passenger planes will be operated with motor fuel of 100-octane or higher.

The dominant position of polymerization in the economy of motor fuel production is also definitely established in that small amounts of polymer gasoline may be used to correct an octane deficiency in the gasoline production of the refinery and thus function to balance the quality of motor fuel produced.

Summary

1. The polymerization process is one of the most important developments in the petroleum refining industry. More than 9,000,000,000 gallons of polymer gasoline may be produced yearly from the hydrocarbon gases in the United States, of which over 1,000,000,000 gallons may be isooctane fuel of 95 to 100 octane rating.

2. Three modifications of the polymerization process have been described. (1) Polymerization of hydrocarbon gases containing propene and butene.; (2) pyrolytic cracking of butanes(and also propane) to produce olefin hydrocarbons followed by catalytic polymerization to produce polymer gasoline; (3) selective polymerization of normal and isobutene and hydrogenation of the resulting octenes into isooctanes.

3. A commercial plant has been described processing daily 13,070,000 cubic feet of cracked gas containing 19.2 per cent of propene-butenes, polymerizing 79.5 per cent of these olefins and producing 1,080 bbls. of true polymer in addition to 974 bbls. of butanes. When treating a cracked gas containing 25.4 per cent of propene-butenes at the daily rate of 13,874,000 cubic feet, a total of 1,474 bbls. of true polymer was produced and 1,152 bbls. of butanes. The percentage of propene-butenes polymerized was 86.5 per cent. In another commercial plant treating approximately 1,500,000 cubic feet of gas per day containing 38 per cent propene-butenes, the production was 250 bbls. of polymer gasoline with a polymerization of 89 per cent of the propene-butenes present.

4. A commercial plant comprising a combination butane cracking and catalytic polymerization process charges butane at the daily rate of 1,090 bbls., producing 402 bbls. of polymer gasoline made up of 109 bbls. of pyrolytic polymer and 293 bbls. of catalytic polymer gasoline.

5. A commercial plant has been described treating butane-butene mixtures to selectively polymerize the normal and isobutenes contained therein having a daily capacity of 1,300 bbls. of butane-butene fraction from which was produced 347 bbls. of isooctenes. The isooctenes are catalytically hydrogenated to isooctanes, the latter having octane ratings of from 90 to about 100 dependent upon the conditions under which they are produced.

6. The economic position of the polymerization process for the production of polymer gasoline to improve the octane rating of the refinery output or as a step in the process of making isooctanes is now in relatively wide use in the oil industry.

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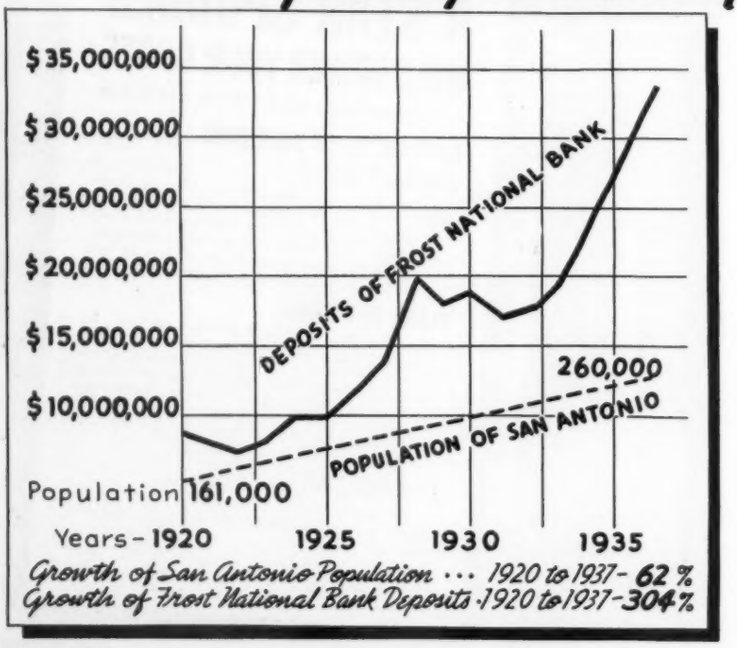

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Aircraft Operation With Fuels of 100 Octane Number and Higher

By S. D. HERON
Ethyl Gasoline Corp.

The constant increase in specification requirements of petroleum products for aircraft engine use has often been a thorn in the flesh of the manufacturing departments of the oil industry. The refiner is at times inclined to regard the demands for products which are increasingly difficult to produce and steadily more costly as unjustifiable whims of the aircraft industry. That the developments of the last 10 years, which have turned commercial aviation from a struggling infant into a fairly mature adult, are due in no small measure to improved petroleum products is not generally appreciated in the refineries. The use of 70-octane fuels in most modern multiengine transport aircraft would preclude the carrying of any payload.

It would appear that the trend of aircraft fuels is bound to be in the direction of a progressive steady increase of octane number. This will involve the use of synthetic fuels which many refineries cannot manufacture economically at present. Refiners who assume that the present trend of octane numbers is evidence of unsound development methods on the part of the aircraft industry would seem to be due for a rude awakening.

In this paper an attempt will be made to survey: History of fuel and concurrent engine development, effect of octane number on engine performance, relation of engine and aircraft performances, and the relation of engine performance to aircraft earning capacity.

Fuel Development and Its Past Influence on Engine Development

In 1928 fuel of 50 octane number was in general service use, but was found to have destructive effects on the larger air-cooled engines. Attempts to control antiknock value were ineffective until the octane-number scale was adopted in conjunction with standardized knock-test methods. These knock-test methods gave results which were reliable indices of full-scale engine behavior only in the case of straightrun gasolines, either clear or blended with lead. With the establishment of a workable method of defining fuel antiknock quality which gives a reasonably accurate index of full-scale engine value, the possibilities of increased engine performance with the higher octane-number bracket soon became generally appreciated. The U. S. Army Air Corps standardized 87-octane fuel (about 84 A.S.T.M. octane number) for all uses except training, and 73 and 80 octane numbers soon became standard for commercial use. Fuel of 87 A.S.T.M. octane number came into limited commercial use for take-off purposes. With the introduction of the Douglas DC2 airplane, 87-octane take-off fuel came into general commercial use in conjunction with 80-octane fuel for cruising. In general, engines using 87-octane take-off fuel and 80-octane cruising fuel in commercial service were, and are, so supercharged that the normal cruising power can be maintained up to an altitude of about 12,000 feet, beyond which it begins to fall off. There is now a general demand for the maintenance of normal cruising power to higher altitudes, and engines are now so supercharged that cruising power can be maintained to an altitude of about 15,000 feet, and this has resulted in the use of 87-octane fuel for cruising. The demand for minimum fuel consumption at the cruising condition has also been a contributing factor in the use of 87-octane fuel for cruising. Take-off fuel of 90 A.S.T.M. octane number is now in limited commercial use.

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

Fuels up to 87 octane number with 3 cc. lead can be generally produced from selected straightrun naphthas. Fuel of 90 A.S.T.M. octane number, with 4 cc. lead, can be produced from straightrun naphtha. When more than 87 octane number is required with a 3-cc. lead limitation, the use of synthetic blending agents then becomes essential.

Results of tests with 100-octane (Army method) fuels by the U. S. Army Air Corps were given early in 1935 by Klein.[1a] Most of the fuels tested contained commercial *iso*octane, and the results served to show the possibilities of increased engine performance with fuel octane numbers in excess of the then current 87 A.S.T.M. However, 100-octane fuel has as yet had only very slight commercial use, although it appears inevitable that it will come into such service on account of the demands for maximum take-off power and minimum specific fuel consumption at cruising. The aircraft-users' demands for take-off power and cruising economy apparently can only be met with 100-octane fuel even with the most advanced of available engines.

[a] Figures refer to bibliography.

TABLE 1

Range hours	Payload revenue (dollars per pound mile)	Premium, per cent cost of 87-Oct. No.	Premium, dollars per U. S. gallon over 87-Oct. No.	Premium, cents per Oct. No.
0	$0 000385	63	$ 16	1 2
0	0 00077	121	.30	2.3
4	0 000385	122	.31	2.4
4	0 00077	240	.60	4.6
8	0 000385	182	.46	3 5
8	0 00077	360	.90	6 9
16	0 000385	300	.75	5 8
16	0 00077	600	1 50	11.5
20	0 000385	360	.90	6 9
20	0 00077	716	1 79	13.8

TABLE 2

Range hours	Payload revenue (dollars per pound mile)	Premium, per cent cost of 87-Oct. No.	Premium, dollars per U. S. gallon over 87-Oct. No.	Premium, cents per Oct. No.
0	$0 00025	71	$ 11	0 8
0	0 0005	133	.20	1 5
4	0 00025	134	.20	1 6
4	0 0005	259	.39	3 0
8	0 00025	197	.30	2 3
8	0 0005	385	.58	4 4
16	0 00025	323	.49	3 7
16	0 0005	635	.96	7 4
20	0 00025	386	.58	4 5
20	0 0005	760	1.14	8 8

TABLE 3

Range hours	Payload revenue (dollars per pound mile)	Premium, per cent cost of 87-Oct. No.	Premium, dollars per U. S. gallon over 87-Oct. No.	Premium, cents per Oct. No.
0	$0 000385	710	$1 78	13 7
4	0 000385	650	1.63	12 5
8	0 000385	595	1.48	11 4
16	0 000385	478	1.19	9 2
20	0 000385	420	1.05	8 1

Special aircraft engine fuels, usually containing alcohols and high percentages of aromatics and producing abnormally-high performance for racing and other stunt purposes, have been used in the past; but, apart from cost and limited supply, such fuels have had limitations which made them considerably inferior to normal 87-octane fuels for general service use.

The advent of 100-octane fuels using *iso*octane, blended with straightrun gasoline as a base, resulted in a high-octane fuel which was free of the operating disadvantages of the stunt type of fuel. Fuel blends of 100 octane number, containing *iso*octane, can be used with the same operating technique that is observed with current fuels using gasoline alone as a base. With *iso*octane-gasoline blends the problems of storage, contact with water, fuel-tank capacity, fuel-system and carburetor freezing, and carburetor settings are essentially the same as those involved with the use of gasoline.

Blending agents other than *iso*octane are available for the production of fuel blends of 100 octane number or more. *Iso*octane, however, is the only blending agent with any considerable background of service use, and the following discussion of high-octane fuels is confined to blends made with *iso*octane as the major base blending agent. Limitation of discussion to *iso*octane blends does not infer that other blending agents have not a present wide field of application or may not have wide use in the future. While the discussion is limited to *iso*octane blends, it should be noted that such blends generally contain *iso*pentane, which gives the finished blend volatility characteristics similar to the present types of aviation gasolines.

At least half of the improvement in aircraft engine performance in the last 10 years is due to increase of fuel octane number[2] and to the use of the octane-number scale in conjunction with methods of measuring octane number, which result in any given grade of fuel giving substanially uniform service performance in any given engine type. High-octane fuels would be of little value if the effective full-scale engine octane number was subject to considerable variation from batch to batch.

Aircraft engines can be designed for satisfactory operation on 50-octane fuel. The Curtiss D-12 water-cooled 12-cylinder engine and many 200-hp. air-cooled training engines have given very satisfactory results on fuel of 50 to 55 octane number. It is probable that aircraft engines can be produced which will develop 50 per cent more mean effective pressure on 50-octane fuel than do present automobile engines on 70 octane number. There is no question, however, that such engines are not, and

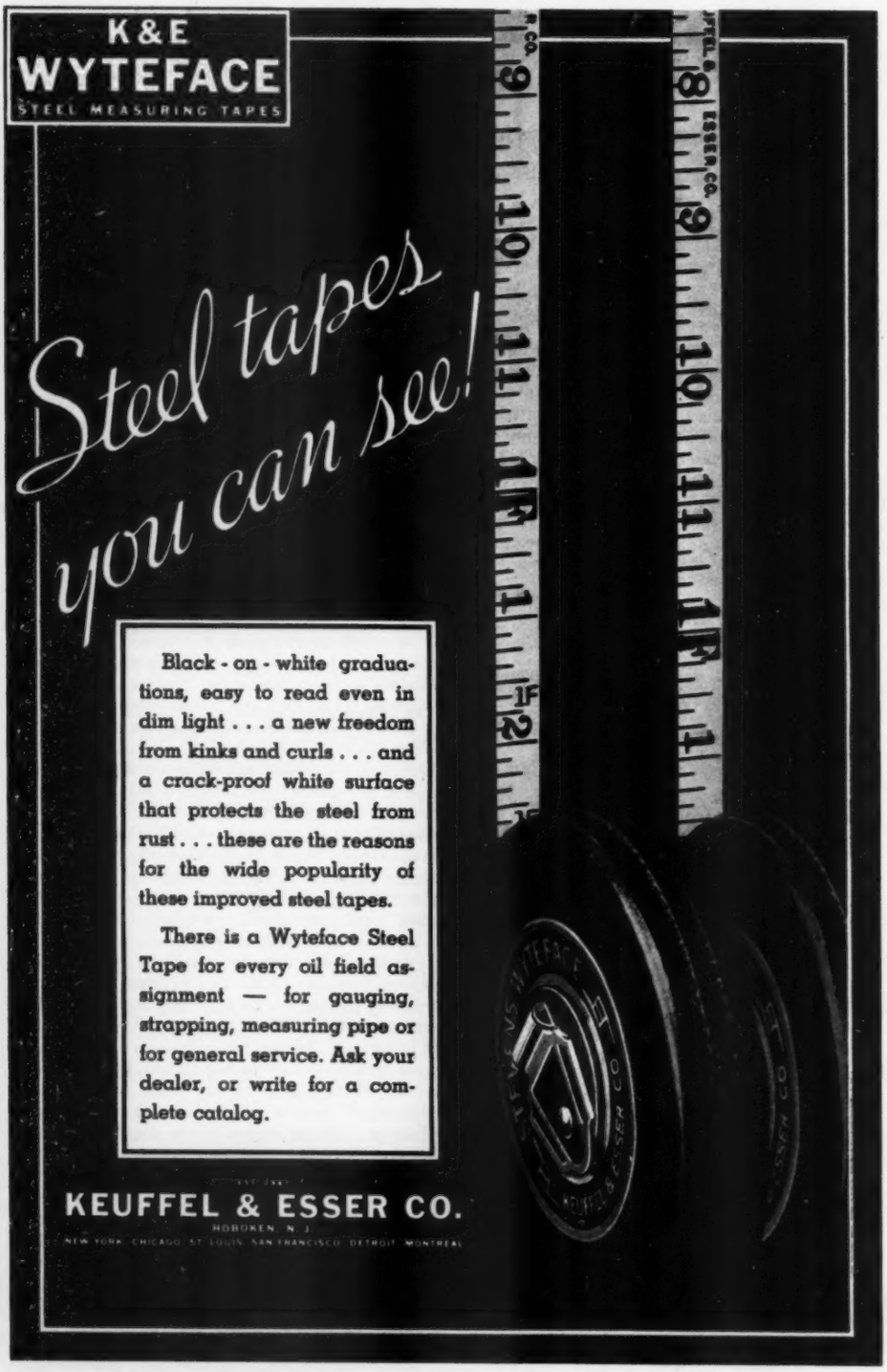
would not be, acceptable for high-performance aircraft use as long as the present type using high-octane fuels is an available alternative.

Aircraft is only able to compete with other forms of transportation by virtue of its performance. Point-to-point speed and ability to reach high altitude are the major items of aircraft performance by means of which it successfully competes with other forms of transport. From the military standpoint 60-m.p.h. airplanes might have a limited field if they could reach any given altitude more rapidly than a balloon, but such a speed entirely eliminates the airplane from true commercial use.

It has argued that the aircraft industry is obtaining increased output and performance by the use of higher octane numbers rather than pursuing the apparently sounder course of obtaining high output and performance with fuels of about 70 octane number; 1,500 hp. per engine is now available with 100-octane fuel, and it would take at least two years to develop an engine to give the same output on 70-octane fuel, even if all restrictions as to size and weight were removed.

While engine development may result eventually in obtaining the same over-all performance on 70-octane fuel as is now obtained with 100-octane fuel, such a result is at best problematical, and the aircraft industry wisely took advantage of a proven improvement rather than spend largely in time and effort attempting to secure a probable but uncertain result.

The aircraft-engine industry is continually striving for the production of increasingly powerful engines, as witnessed by the introduction of 1,400-1,500-hp. engines this year in this country. However, the production of more power by the mere increase of cylinder capacity sometimes results in increased engine power without increase of aircraft performance. In addition, large increase in engine-cylinder capacity, as a means of obtaining increased power, may result in a much greater increase of over-all cost of development than the use of higher-octane fuels, since the engine industry is not always on sure ground when jumping from an existing engine type to one with 30 per cent greater cylinder capacity.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The Effects of Octane Number on Engine Performance

The more important effects of octane number on engine performance will be surveyed in the following discussion. The wide difference in engine and fuel conditions at take-off and cruising operation is not usually understood by those outside the aircraft field. It is often assumed that the best specific fuel consumption the engine will give is obtained at its maximum possible mean effective pressure. Thus, a mean effective pressure of 200 pounds per square inch is often associated with a specific fuel consumption of 0.40 pound. Both of these are possible in some engines, but not simultaneously.

a. Relation of Take-off to Cruising Conditions

Since at the take-off condition the maximum possible power is required, all available methods of increase are resorted to. Detonation or other forms of uncontrolled combustion are most likely to occur in the range of air-fuel ratios between that giving maximum power and that giving complex combustion. It has been found that high fuel consumption will, within limits, make possible the same power output as is available with a higher-octane fuel running leaner. Thus, Klein[3] reports sensibly similar output and cylinder temperature on 92- and 100-octane fuels, with the latter having a 19 per cent lower specific consumption. Rich mixture in lieu of high octane number has its limits, however, since excessive loss of power occurs if carried too far. For take-off at present, mixtures somewhat richer than those giving maximum power are general. Specific fuel consumption at take-off is quite generally as high as 0.7 pound per B.h.p.h.* but this is unimportant since the total quantity of fuel used in the take-off and initial portion of the climb is quite small in comparison with the total fuel load. The cruising power is generally of the order of 60 per cent of the take-off power, the mean effective pressure being about 75 per cent of that at take-off. Since at the cruising condition, both mean effective pressure and mixture temperature are lower than at take-off, the stress on the fuel is much reduced, and air-fuel ratio can be considerably increased. In present practice, cruising consumptions in flight of less than 0.45 pound per B.h.p.h. are reported.

b. Power

Klein[1] in the first published performance data on comparison of 100-octane (Army method) fuel vs. 9-octane (Army method — approximately 87 A.S.T.M.) fuel showed that the permissible increase of power was 12 to 30 per cent, depending on engine type and operating conditions.

DuBois and Cronstedt,[4] using a supercharged full-scale single-cylinder engine, found that technical *iso*octane permitted 17 per cent more power output than 92-octane fuel (Army method—approximately 87 octane number, A.S.T.M.).

Current model engines in the 1,000-1,500-hp. class have 15 to 20 per cent higher take-off ratings with 100-octane fuel than with 87-octane.

DuBois and Cronstedt[4] have shown that *iso*-octane plus 3 cc. of lead will allow an output increase of more than 17 per cent over that available on *iso*octane alone. Klein[3] has shown that *iso*ctane plus 3 cc. lead will give 55 per cent more power than *iso*octane alone. Studies in a supercharged engine in the laboratories of the Ethyl Gasoline Corporation have shown that fuels of over 100 octane number may give more than 160 per cent of the

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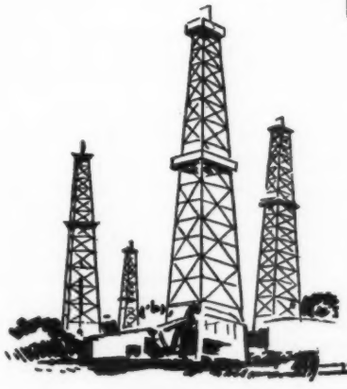

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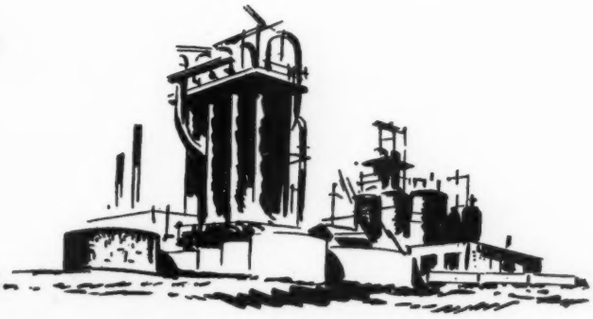

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power available on pure *iso*octane, or 250 per cent or more of that available on 70-octane fuel.

c. Fuel Economy

Young[6] has shown that a specific fuel consumption of 0.35 pound per B.h.p.h. can be obtained on the dynamometer with a large air-cooled engine operated at essentially cruising conditions on 100-octane fuel. This engine had a compression ratio of 7.85 to 1 in order to obtain the maximum fuel economy with 100-octane fuel. A similar engine, with a 6.4 to 1 compression ratio and using 92-octane (Army method) fuel, gives a best fuel economy of about 0.42 pound per B.h.p.h. The engines with 7.85 to 1 and 6.4 to 1 compression ratios have about the same available take-off powers on the fuels they are designed for, viz., 100 and 87 octane number.

Klein[3] has reported comparisons of 100- and 92-octane (Army method) fuels using the same type of engine as that discussed by Young.[5] Klein's engine had a compression ratio of 6.45 to 1; but, owing to differences in operating conditions and possibly owing to slight design modifications, gave much higher cylinder temperatures than shown by Young's data for the same compression ratio, at essentially similar output and revolutions per minute. At an output of 565 to 570 hp., Klein's data indicate that the minimum specific fuel consumptions just avoiding detonation are approximately 0.55 and 0.68 pound, respectively, for 100- and 92-octane fuels. Thus the difference in fuel consumption at fixed compression ratio and output is approximately 19 per cent lower for 100-octane than for 92-octane fuel. Young, by varying compression ratio to secure maximum economy at about the same power as Klein, with 92- and 100-octane fuels obtained a reduction in consumption of about 17 per cent for the 100-octane fuel.

In general, the reduction of consumption that may be expected as a result of the use of 100-octane fuel in place of 87-octane (A.S.T.M.) is at present the subject of considerable discussion, with various estimates being used for the purpose of calculation. As Young has pointed out, it is not now possible to cruise engines in flight at the minimum consumptions obtainable on the dynamometer. However, with accurate measurement of both fuel flow and power[2] in flight now possible, cruising consumption in the air may be expected to become increasingly closer to the optimum dynamometer possibilities. It is the author's opinion that 100-octane engines, suitably installed and operated, may be expected to give between 10 and 15 per cent lower consumption than equally efficient equipment designed for 87-octane (A.S.T.M.) fuel. Thus, if 0.44 pound per B.h.p.h. is being achieved with 87-octane fuel, 0.38 to 0.40 pound may be expected with 100-octane fuel. If existing 87-octane equipment is being operated under too severe cruising conditions, the substitution of 100-octane fuel without equipment change may well be expected to render possible a fuel consumption reduction of more than 10 to 15 per cent.

That leaning off the air-fuel mixture is, in general, more important in securing reduction of fuel consumption in aircraft engines than is compression ratio is not usually appreciated outside the aircraft-engine field. In the past in the aircraft engine field, and at present in other engine fields, reduction of consumption by leaning off the mixture has been avoided on account of exhaust-valve burning and other troubles. Browne[8] was the first to emphasize the relative effects of mixture strength and compression ratio on fuel economy, and his remarks were startling to many engineers not familiar with aircraft engine practice.

Mead[2] has stated that cruising at extremely low fuel consumption is the most critical condition that modern engines have to meet. Until demand for minimum cruising consumption became pronounced, the take-off condition was much the more critical than cruising.

Thus, the gains in engine performance due to 100-octane fuel in place of 87-octane fuel may be summarized as: a power increase of up to 30 per cent, reduction of cruising fuel consumption of 10 to 15 per cent, and the probable attainment of cruising fuel economy closely comparable with that of a compression-ignition engine.

The Effects of Octane-Number Increase on Aircraft Performance

Experience is now sufficiently extensive that the engine effects of octane-number increase can be foretold within limits. From the change of engine performance, the effect on aircraft performance can be fairly definitely predicted. The effect of octane-number increase on earning power of commercial aircraft is much more indefinite than the change in aircraft performance. Several mathematical surveys of the economic value of 100-octane fuel vs. 87-octane fuel have been made, and arrive at widely different answers.

Some rather elementary discussion of the effects of engine performance of modern aircraft operation is thought to be justified at this stage.

a. Speed

The direct effect of power on speed at any given altitude is slight. Thus, a 10 per cent increase in power at the best produces only a 3 per cent speed increase, and usually considerably less than 3 per cent. While the direct effect of power on speed at any given altitude is slight, the effects of maintaining power to increasing altitude has had very large effects on speed. If engine power is held constant, irrespective of altitude, the airplane speed increases with altitude due to reduction of resistance as the air density falls off. Thus, when density has been reduced to 70 per cent (approximately 10,000 feet) of that at sea level, airplane speed will have

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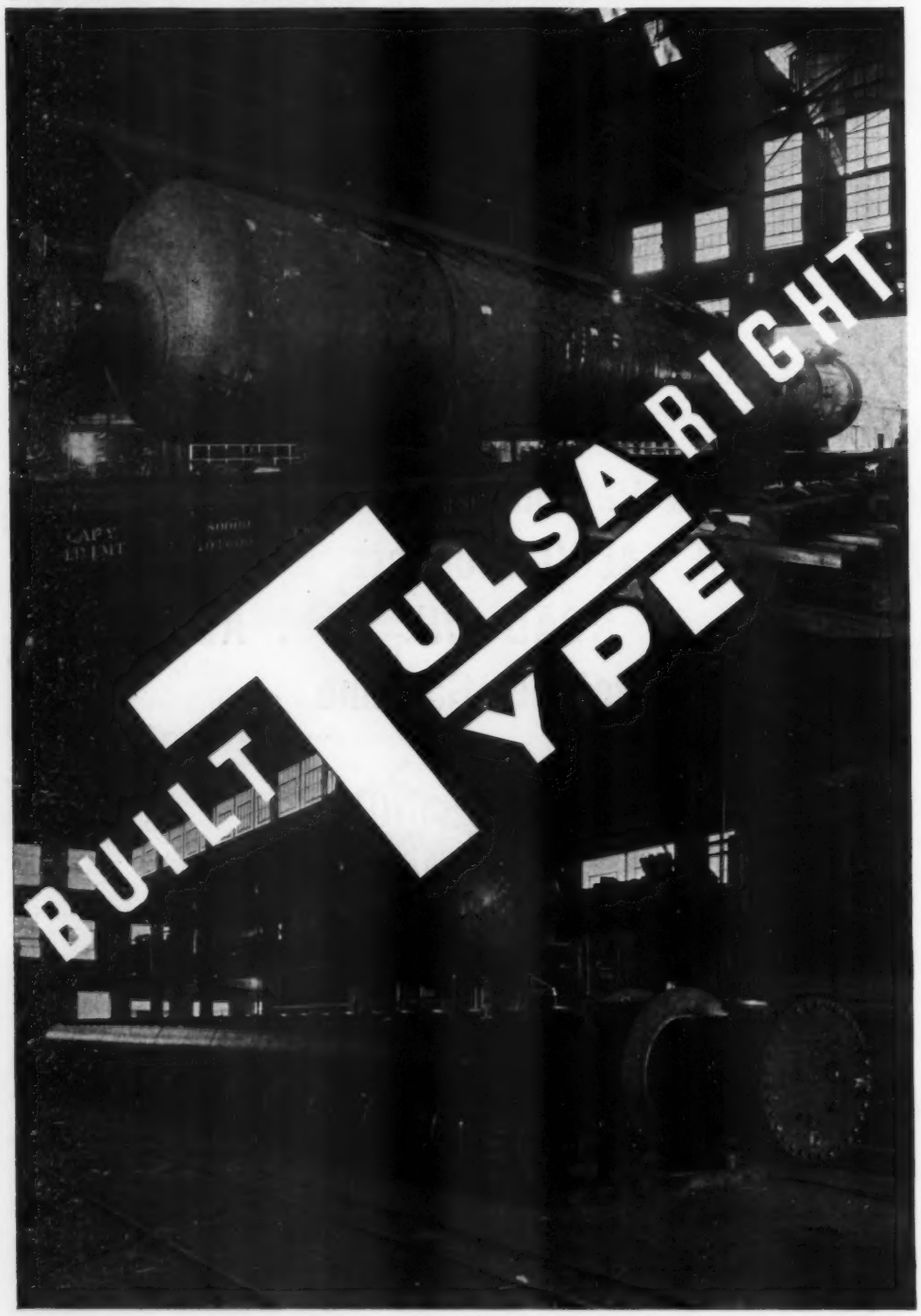

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increased by about 20 per cent. The modern clean airplane, equipped with flaps and controllable pitch propellers and having high wing loading, achieves with relatively low engine power remarkable cruising speed at altitudes of 10,000 to 15,000 feet. In general, as the altitude to which a given power must be maintained is increased, so are the octane-number requirements raised. The reduction of air density with increase of height is counteracted by more supercharging. This usually involves higher mixture temperatures and greater indicated power, both of which increase the stress on the fuel.

b. Take-off

With current land-plane types, the critical condition of power requirement is at take-off—since it is necessary to secure sufficient ground speed for the ship to become air-borne and to have a sufficient rate of climb to be able to gain altitude sufficient to clear obstacles at the boundaries of modern major airports. Barnard,[7] in a recent survey, has shown that modern land-transport airplanes have an average take-off weight of 13 pounds per take-off horsepower.

The high speed of modern aircraft is to a very considerable extent the result of the large increase in take-off power produced by recent engine, propeller, and fuel improvement and, particularly, to the constant-speed propeller which enables the engine to develop its full take-off power throughout the take-off run and the initial portion of the climb. The great increase in effective available take-off power in recent years has resulted in high-speed designs of aircraft which could not have taken off with the older-engine and propeller equipment.

Increased take-off power may find its greatest value in reducing the length of the take-off run and distance traveled before an obstacle of given height can be cleared. One large aircraft operator has calculated that, in the case of large multi-engine transports, a 20 per cent increase in take-off power will reduce by 45 per cent the distance necessary to take off and reach a height of 50 feet. On these figures it is indicated that, if a change from 87- to 100-octane fuel produces a 20 per cent gain in take-off power, a ship using 100-octane fuel can obtain the same standard of safety in take-off from a 180-acre airport as given by 87-octane fuel from a 600-acre airport (both airports rectangular and geometrically similar). The problem of take-off has become sufficiently critical to warrant consideration being given to either a considerable increase in airport size or the use of catapulting.[8,9] The area and cost of airports usually increase sensibly as the square of the length of the take-off runway, and airport costs are already very high. Hence, it would appear that engine or fuel developments which result in rendering available increased power for the short period necessary for take-off are likely to have very considerable economic value. Catapulting of land airplanes will, of course, involve considerable expense, and further limits operation to and from airports equipped with catapults.

Catapulting of seaplanes is already in use in experimental transatlantic air service. It would seem obvious that the investment in and operating cost of catapult mother ships must be so high that take-off fuels costing as much as $50 a gallon would be economically justified if they rendered possible an unassisted take-off.

In seaplanes and flying boats, the take-off condition is somewhat less critical than in land transport—since the allowable take-off distance is not, as a rule, affected by obstacles surrounding the take-off course. No matter what the length of run available, however, take-off time or distance is limited by the fact that the engine overheating will occur if the take-off run at low air speed is extended beyond certain time limits peculiar to each installation. In flying boats, increase of take-off power would appear to be essential in many cases of very long-distance nonstop operation, where crew, fuel, oil, and equipment loads now represent 90 per cent or more of the disposable load.

c. Fuel Consumption and Range

Increase of fuel octane number may be used to increase airplane range by three methods:

1. The first is to increase the available take-off horsepower by more supercharging at take-off, thus allowing a greater fuel load to be carried. In this case reduction of specific fuel consumption at cruising may or may not be obtained, depending on the severity of the engine operating conditions.

2. In the second case the engine compression ratio is increased to give minimum possible fuel consumption available with the fuel to be used at the required cruising power. In this case the compression ratio is likely to be increased to the point where take-off power is no greater than that obtained with the formerly-used lower-octane fuel and engines with lower compression ratio.

3. The third method involves increase of compression ratio and take-off power, the compression ratio being increased sufficiently to have a noticeable effect on cruising fuel consumption and yet permitting a considerable increase in take-off power.

It is the author's opinion that the third method is most likely to be followed in the immediate future when new airplanes are being produced for use with 100-octane engines.

In some equipment now in service, and operating over short distances where fuel load is not significantly affecting payload, there is no doubt that safety would be increased by the use of take-off fuel of more than 87-octane number. However, this would involve the use of a double fuel system, which is not always considered desirable.

Earning Capacity of Commercial Aircraft

Bass[10] has made mathematical investigations of the effects of 87- and 100-octane fuels on earning

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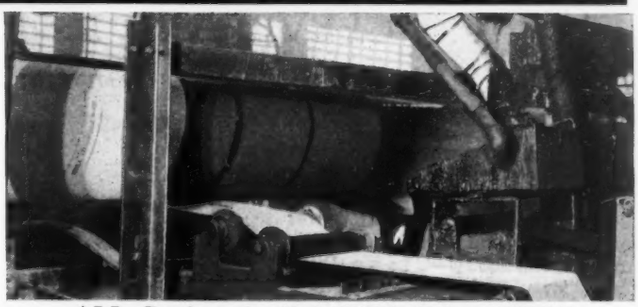

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capacity of transport airplanes at 100 per cent load capacity. The first type of investigation deals with the case of an existing airplane fitted with 87-octane engines which are to be replaced with 100-octane engines of the same take-off power. The 100-octane engines have their cylinder capacity reduced (apparently by 20 per cent) and their specific weight is 9½ per cent less than the 87-octane engines. The cruising specific fuel consumption is 9½ per cent less with 100-octane fuel than with 87-octane. With assumptions of 25 cents per U. S. gallon as the cost of the 87-octane fuel and payload values of $0.000385 and $0.00077 per pound-mile (approximately 7½ cents and 15 cents per 200-pound passenger-mile) at a cruising speed of 160 m.p.h., the premium values of 100-octane fuel found are as shown in Table 1 for various flight ranges.

If Bass' data are recalculated—substituting payload revenues, 87-octane fuel costs, and fuel gravities which approximate the average in this country—the premium values become as shown in Table 2. In calculating Table 2, 87-octane fuel costing 15 cents per U. S. gallon, payload values of $0.00025 and $0.0005 per pound-mile (5 cents and 10 cents per 200-pound passenger-mile), and fuel gravities of 70 A.P.I. for both 87- and 100-octane fuels have been assumed. The 20-hour-range condition dealt with by Bass closely resembles a 2,300-mile nonstop transoceanic flight with 40 per cent reserve fuel.

Bass also considers the case of the relative carrying power of an 87-octane airplane and a 100-octane airplane, both with engines which are similar in cylinder capacity and other respects, except output and cruising consumption. For the 100-octane engine the take-off power is increased 20 per cent, the specific cruising fuel consumption reduced by 9½ per cent at 20 per cent increased cruising power. The specific weight of the 100-octane engine is assumed to be decreased by 9½ per cent—the actual weight, therefore, being about 9½ per cent more than the 87-octane engine. With other assumptions as to fuel cost, fuel gravities, etc., similar to those used in Table 1, Bass concludes that the premium values of 100-octane fuel for various flight ranges are as shown in Table 3.

Barnard[7] has made an extremely comprehensive investigation of the effects of octane number on earning power with the aircraft loaded to capacity. The effects on payload of increased take-off power obtained by raising boost and of increasing compression ratio, the latter reflected only in reduced cruising fuel consumption without change of take-off power, are examined. The investigation is based on earning power per pound (or gallon) of fuel, and the earning power resulting from any octane-number change is not related to any particular basic cost for, say, 73- or 87-octane fuel. The basic equation used credits increased take-off power with either a larger and heavier airplane or, conversely, only a fraction of the increased load taken off is considered as disposable load. Calculated data showing the effects of specific payload revenue loads (dollars per pound-mile) and a range of disposable loads (disposable load equals crew plus oil and fuel plus revenue load) per available take-off horsepower are included. Amongst the most important of Barnard's findings are the following:

1. That the change of earning capacity per octane number varies from about 2¼ cents to 8 cents per gallon, depending on operating conditions.
2. Earning capacity per octane number is proportional to specific payload revenue.
3. Range has only a slight effect on the earning capacity per octane number.
4. That increase of compression ratio to obtain minimum cruising fuel consumption and increased take-off power obtained by added supercharging, without affecting cruising fuel consumption, have sensibly equal effects on the incremental earning power per octane-number increase.
5. "The indicated increases in earning power are so much greater than any probable fuel-cost increases that the upward trend of octane-number requirements and use is clearly evident."

Keith, Carey, and Ward[11] have examined the earning capacities of 87- and 100-octane fuels in existing aircraft on a 720-mile nonstop flight. The relative earning capacities of the two fuels are considered on a basis of cruising specific fuel consumption. The airplane has a maximum permissible take-off weight, and reduction of fuel consumption enables more payload to be carried. The 87-octane engines are assumed to be replaced with 100-octane engines, and the latter are assumed to give a 15 per cent reduction in specific cruising fuel consumption, and take-off and cruising powers are assumed to be the same for both engine types. The decreased fuel consumption with 100-octane fuel is considered in terms of its value from zero to 100 per cent load factor, i.e., from no passenger, mail, or express load to maximum allowable take-off weight. Various distributions of load factor, such as half the flights with no payload and half with capacity payload, are examined. Keith, Carey, and Ward make the point that increased earning power based on capacity payload can never be fully realized in practice. On the above bases it is calculated that the payload may be increased by 11 per cent by the use of 100-octane fuel, and that as long as the payload does not exceed 90 per cent capacity (on 100-octane fuel) the earning power of the 100-octane fuel is only 2.1 cents per gallon more than that of the 87-octane fuel. As the payload increases beyond 90 per cent, the incremental value of 100-octane fuel becomes greater—reaching 25.5 cents per gallon with the airplane fully loaded. If only 10 per cent of the flights are made with capacity load, the incremental value of 100-octane fuel becomes 4.5 cents per gallon.

The opinion is expressed that due to fixed charges, etc., of the potential increased payload revenue, only 25 per cent can be credited to the fuel. This, together with the savings in total fuel consumption, gives a net premium earned by 100-octane fuel of 2.1 cents per gallon for no full-capacity loads, 2.7 cents when 10 per cent of the flights carry full-capacity load, and 7.9 cents when all loads are full-capacity.

When Bass' data in Table 2 are compared with those of Barnard, they are at least of the same order of magnitude, i.e., roughly 2 to 8 cents per gallon increased earning capacity per octane-number increase. Keith, Carey, and Ward show a value for increased earning power of 2 cents per gallon per octane number at 100 per cent load factor. Bass' and Barnard's computations are both on a basis of 100 per cent load factor, and their figures for the minimum incremental earning power per octane number are in agreement with Keith, Carey, and Ward's maximum. The minimum value per octane number computed by the latter authors is 0.16 cents per gallon per octane number. It is this author's opinion that Bass is somewhat optimistic in crediting 100-octane fuel with both a 20 per cent increase in specific take-off engine output and a 9½ per cent reduction in specific cruising consumption. It is granted, however, that with some engines, under suitably chosen operating conditions, increase of octane number from 87 to 100 can be expected to increase power by more than 20 per cent and decrease cruising consumption by more than 9½ per cent.

The data of Keith, Carey, and Ward on all up-weight, disposable load, fuel consumption, etc., for the transport used in their calculation may be used for a flight of double the length they assume. Using their figures for ratio of fuel consumptions on 100- and 87-octane fuels and for warm-up and take-off fuel weight—doubling the cruising and reserve-fuel supply and increasing the oil load by 50 per cent—the payload becomes about 1,100 pounds for 87-octane fuel and about 2,000 pounds for 100-octane fuel. At 5.75 cents per 200-pound passenger mile (assumed by Keith, Carey, and Ward) the increased earning capacity of the 100-octane fuel becomes approximately 48 cents per gallon, or 3.7 cents per

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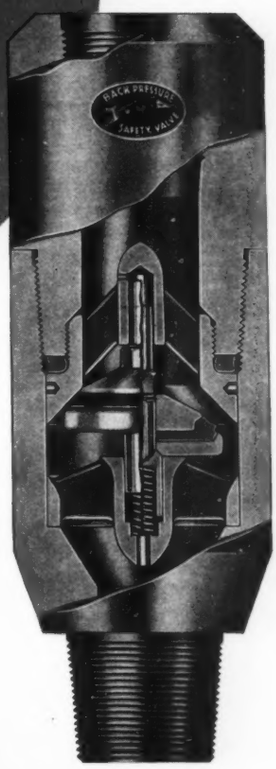

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octane number, at 100 load factor. This last figure for earning capacity serves to emphasize the importance of fuel consumption in long-range operation.

Summarizing the findings of Bass, Barnard, and of Keith, Carey, and Ward, the increased earning power of 100-octane fuel over 87-octane fuel varies from 2 cents to $1.79 per gallon. In each of the three investigations the increase of earning power depends on a number of variables such as proportion of flights made with capacity payload, flight range in nonstop hours, and specific payload revenue. The highest premium value of $1.79 per gallon is obtained by Bass, with a specific payload revenue value of approximately 15 cents per 200-pound passenger-mile on a 20-hour nonstop flight.

If Keith, Carey, and Ward's final estimate of 3 to 6 cents per gallon increased net earning power for 100-octane fuel over 87-octane fuel is taken in conjunction with their estimate of only 7 to 9 cents per gallon manufacturing cost of *iso*octane, it would appear certain that there is an immediate field for 100-octane fuel in existing commercial aircraft.

In the military field, the advantages of increased power, improved cruising fuel consumption, or both together, are so pronounced that cost is entirely secondary as long as potential supplies are adequate. Potential supplies of blending agents for the manufacture of 100-octane fuels[12,13] appear to be in excess of any likely demand. In the military field the demand for performance is so intense that all possible means of improvement are taken advantage of, and none can be safely neglected. Thus with advance of engine development, a continual demand for further fuel improvement can be expected.

Fuel Gravity and Heat Content

Fuels of 100-octane number consisting of *iso*-octane and gasoline are generally uniform in gravity and heat content per unit volume. This is of importance, since modern engines are generally equipped with automatic carburetors which control the fuel supply required by the various conditions of operation by metering substantially on a volume basis. Both the aircraft and petroleum industries must face the fact that such controls cannot be effective with fuels which vary widely in heat content per unit volume. Thus, when using a blend containing 60 per cent or more of aromatics, and which is equally as effective in all respects as one made with gasoline and *iso*octane, the aromatic blend will waste fuel when used with carburetor controls set for an *iso*octane blend. If the carburetor controls are set for the aromatic blend, the engine will be dangerously lean on the *iso*octane blend. In lieu of development of suitable carburetor controls for controlling fuel supply on a heat-content basis, it is to be expected that any one aircraft operator is likely to demand that his fuel supplies shall be practically uniform in heat content per gallon.

Conclusion

Aircraft operators in general have shown a regretable tendency to consider fuel costs in terms of price per gallon. Fuel costs are a considerable item in operating cost, and the operator's reluctance to face increased gallonage cost is understandable. Cost per pound-mile of disposable or payload is, however, the real criterion of operating expense, and this may well bear no relation to cost per gallon when considering fuels of different octane numbers.

The wide differences in engine operating conditions at take-off and cruising are not usually familiar to those outside the aircraft industry. Discussion, in rather elementary terms of these phases, as influenced by fuel octane number has, therefore, been included.

It is to be expected that, following the general use of 100-octane fuels, investigation will be concentrated on the improvements available as a result of still higher antiknock values. *Iso*paraffins of higher antiknock value than *iso*octane are known. One of these at least appears to be in all respects a desirable aircraft fuel, and to be not impossible of commercial synthesis.

Acknowledgements

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There was completed this year a decade of work on the chemical constitution of petroleum under the program begun jointly in 1927 by the American Petroleum Institute and the National Bureau of Standards, and carried on as A.P.I. Research Project 6 in the laboratories of the National Bureau of Standards at Washington. During this period the project has contributed much new and significant information on the chemical constituents of petroleum; has devised new, and improved existing, apparatus and methods for fractionating petroleum and separating its constituents; and has developed and assembled apparatus for determining accurately the physical properties of the separated hydrocarbons. The present review of the work of A.P.I. Research Project 6 has been prepared in order to mark this 10 years of research on the constitution of petroleum, and to inform potential users of the existence and location of these data and of the conclusions which may be drawn from them.

A.P.I. **— Paper presented at annual meeting, Chicago, 1937.**

The work on the chemical constitution of petroleum at the National Bureau of Standards was actually begun in 1926 by the late Edward W. Washburn, on a modest scale, as a project of the bureau itself. In 1927 the work attracted the interest of the sponsors of the fundamental research program of the American Petroleum Institute, and A.P.I. Research Project 6 was established. It was evident at the start that one big advantage to be gained by the merger of the resources that could be made available for this work by the American Petroleum Institute and the National Bureau of Standards was the possibility of carrying out, for the first time, a complete and unified study of the chemical constitution of one representative petroleum. Because such a comprehensive investigation had never been undertaken, the existing knowledge of the chemical constituents of petroleum, especially of molecules containing more than five carbon atoms, was relatively meager, and divergent with respect to the purposes for which the studies were made. The state of the existing knowledge in 1928 has been well summarized by Gruse.[67] Because a knowledge of the chemical constitution of its raw material is fundamental to the entire petroleum industry, such knowledge could best be ascertained in united and unduplicated effort—leaving the practical application of the data obtained to be made by the various research and development units of the industry.

Since 1928 the Institute's interest in the work carried on at the National Bureau of Standards on the chemical constitution of petroleum has been looked after by a special Advisory Committee for A.P.I. Research Project 6, acting as a subcommittee of the Institute's Committee on Fundamental Research on Composition and Properties of Petroleum, of which J. Bennett Hill is chairman and R. P. Anderson secretary. The special advisory committee for the project, which has made material contributions in shaping the direction and encouraging the progress of the work, has since its inception been headed by J. Bennett Hill. Frank W. Hall, William J. Sweeney, and Merrell R. Fenske complete the committee. Former members are Arthur E. Pew, Jr., C. O. Johns, and George M. Maverick.

In addition to the director of the project, the staff of A.P.I. Research Project 6 has been substantially as follows: to July 1928, two research workers; to July 1930, four research workers and four laboratory assistants; to September 1932, six research workers and four laboratory assistants; to March 1936, five research men and four laboratory assistants; to the present time, six research men and four laboratory assistants. As of September 1, 1937, the research staff consists of R. T. Leslie, B. J. Mair, J. D. White, F. W. Rose, Jr., A. R. Glasgow, Jr., and C. B. Willingham. Former members are M. M. Hicks-Bruun, J. H. Bruun and S. T. Schicktanz. Until his untimely death in February, 1934, the project was actively directed by the late Edward W. Washburn, whose enthusiastic leadership and boundless knowledge served to encourage the research staff in these researches.

For this work on the chemical constitution of petroleum, the National Bureau of Standards makes available five laboratory rooms having a combined floor space of approximately 3,000 square feet, and provides all ordinary supplies and certain apparatus. The project has the privilege of consulting with experts in all the various fields in which the bureau maintains an interest, and also of utilizing the various calibration and testing services of the bureau.

General Method of Operation

Two points were considered important in formulating the research program for Project 6: first, the study should be complete on one representative crude petroleum, so that the results would have a quantitative as well as a qualitative significance; second, the work should be carried out on such a quantity of the crude petroleum that, after its exhaustive separation, the fractions obtained would be substantially pure hydrocarbons in such quantity as to permit purification and

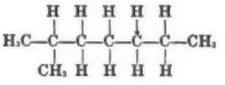
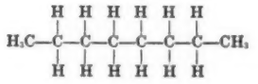
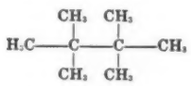
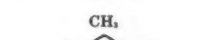
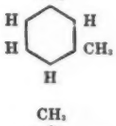
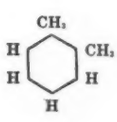
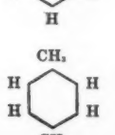
Hydrocarbon	Empirical Formula	Structural Formula	Freezing Point (Deg. C.)
2-Methylheptane	C_8H_{18}		−111
Normal octane	C_8H_{18}		−57
Hexamethylethane	C_8H_{18}		+104
Normal nonacosane	$C_{29}H_{60}$		+64
Metaxylene	C_8H_{10}		−48
Orthoxylene	C_8H_{10}		−25
Paraxylene	C_8H_{10}		+13

Table 1—Effect of symmetry on the freezing point of several hydrocarbons

*National Bureau of Standards, Washington, D. C.; director of American Petroleum Institute Research Project 6. Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

accurate determination of all their important physical properties.

The general method of operation in carrying out such a study of the chemical constituents of petroleum is essentially as follows:

1. A quantity of an appropriate crude petroleum is obtained such that, after adequate fractionation, the significant constituents will each be obtained in an amount sufficient to permit purification and determination of properties.

2. The separation of the material is carried out in such a way as neither to destroy constituents already present nor to produce new ones previously absent. This requirement eliminates the use of all chemical treatment except that which is simple and carefully controlled.

3. The material is exhaustively fractionated by all the available processes into fractions which are "homogeneous" with respect to type and size of molecules. These "homogeneous" fractions are further separated by appropriate processes with the aim of obtaining substantially pure constituents. The end of the fractionation of a given portion of material is reached when, first, it is resolved into pure compounds or, second, when the portions obtained become so small as to make further fractionation impracticable.

4. When no further separation is practicable, the obtained fractions are examined with respect to their identity as pure chemical compounds, and measurements of all their important physical properties are made. When possible, a comparison of these properties with those of appropriate synthetic compounds is made in order to identify the chemical compounds isolated from petroleum.

System of Fractionation

The technique of separating petroleum into its constituents which has been developed by A.P.I. Research Project 6 may be described as the systematic interlocking of the fundamental processes of fractionation and their variations.‡ The order in which the various methods of fractionation are used to separate a given fraction of petroleum is determined by the effectiveness of each given process in furthering the separation already attained by the preceding treatment. Thus, while a given process of fractionation may be impotent when used alone, its systematic use in appropriate combination with other processes can lead to a complete separation of an otherwise unseparable constituent.

In order to measure the degree of separation which is obtained with a given process of fractionation, and to mark the course of separation during a systematic series of fractionating operations, several indicative and conveniently measured properties are determined for the various fractions. In connection with the fractionation of the gasoline fraction of petroleum, the properties of boiling point, refractive index, and freezing point have been used as "indicators" of separation; while for the lubricant fraction the properties of refractive index, boiling point, and viscosity have been found effective for this purpose. In certain fractions, the more difficultly-measured carbon and hydrogen content or ratio may also be determined.

1. Classification of Fractionating Processes

The processes of fractionation employed by the project have been fundamentally the four well-known operations of distillation, crystallization, extraction, and adsorption. Each of these processes has one or more variations which have been found effective in increasing the degree of separation attainable. These are as follows:

(1) Distillation.
  a. Alteration of pressure.
  b. Addition of an appropriate azeotrope-forming substance.
(2) Crystallization.
  a. Simple refrigeration with equilibrium melting.
  b. Refrigeration in an appropriate solvent.
(3) Extraction.
  a. Use of different solvents.
  b. Variation of temperature.
(4) Adsorption.
  a. Use of different adsorbents.

Every process of fractionation is based upon some physical property of the material being separated as, for example, distillation upon vapor pressure or boiling point, extraction upon solubility, and crystallization upon freezing point or melting point (and in certain cases upon solubility of the solid phase). The effectiveness of a given process of fractionation depends upon the difference in the susceptibilities of the respective constituents to the physicochemical conditions imposed by the given process. Under any given set of conditions, those molecules which have nearly the same numerical values of the "vulnerable" property which determines the separation will be the ones most difficult to separate, one from the other; while those molecules which differ appreciably in their values of the given property will be relatively easy to separate. It follows that numerical values of the given "vulnerable" property for the various fractions can be used to indicate the extent of the fractionation.

With respect to the nature of the separation attainable, the processes of fractionation may be divided according to whether they fractionate primarily with respect to size of molecule or to type of molecule. In a separation primarily with respect to size of molecules, or molecular weight,

‡The fundamental principles of fractionation and methods of measurement used by the project have been described many times in the literature, and no originality of such principles is implied in the present report. However, it is hoped that workers in this field may find the review helpful as a summary of such work, and that readers will refer to the research papers of the project (see p. 220) for detailed information as to the manner in which the work has been carried on, the refinements and improvements which have been made in methods and apparatus, and the references to similar previous and contemporary work (see Washburn).[1, 4, 5, 7, 28, 52]

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the end of a fractionation will find molecules of a given type spread among the fractions according to size or molecular weight; and, furthermore, the molecules of different types that will be found in a given fraction will be approximately of the same size or molecular weight, i.e., have about the same number of carbon atoms per molecule. In a separation primarily with respect to type of molecule, a mixture of molecules of different types, and approximately of the same size, will be resolved into fractions each containing substantially only molecules of the same type.

On this basis, the processes of fractionation may be classified as follows:

(1) Fractionation primarily with respect to size of molecules or molecular weight.
   a. Distillation at a fixed pressure.
(2) Fractionation primarily with respect to type of molecules.
   a. Extraction with solvents.
   b. Adsorption.
   c. Distillation at different pressures.
   d. Distillation on addition of an appropriate azeotrope-forming substance.

It is also possible to have a "secondary" separation with respect to size of molecules occurring in the processes of extraction and, to a lesser extent, of adsorption—provided molecules of sufficiently different size are present in the mixture being fractionated. If various types of molecules are also present, such fractionation will result in a displacement, among the various fractions, of the various types with respect to size of molecules.

In connection with separation by crystallization, it should be pointed out that while large hydrocarbon molecules usually have higher freezing points than smaller ones, the effect of the symmetry of the molecule on the freezing point is so marked that it is unsafe to draw any general conclusions. The effect of symmetry on the freezing point is well illustrated by the data given in Table 1. It is seen that normal nonacosane ($C_{29}H_{60}$) has a freezing point 40° C. below that of the highly symmetrical hexamethylethane (C_8H_{18}). Likewise, the freezing point of paraxylene is 61° C. higher than that of its less symmetrical isomer, metaxylene.

2. Distillation

Straight distillation at a fixed pressure is usually the best fractionating process to apply first to a crude mixture. A systematic distillation in highly efficient rectifying columns will serve to separate the material into a series of constant-boiling fractions, each of which will be substantially pure substance, or an ideal solution of two or more compounds having practically the same boiling point, or an azeotropic mixture. The constant-boiling mixtures may then be operated on with one or more of the other fractionating tools. The degree of separation attainable by the simple process of distillation is very much greater today than it was 20 years ago, and even much greater than it was only five years ago. The efficiency of laboratory rectifying columns has increased to such a point that a column equivalent to 100 theoretical plates can be installed in a laboratory room of ordinary height.[14, 30, 64, 65]

Distillation at a different pressure frequently permits fractionation of a constant-boiling mixture, either an azeotropic one or one composed of two or more nearly ideal components having approximately the same normal boiling point at the original pressure, because the components of the mixture may have significantly-different values of the temperature coefficient of the vapor pressure. Because of this change in the relative partial pressures of the constituents, distillation at reduced pressure is particularly advantageous in separating two hydrocarbons of different types which have the same boiling point at atmospheric pressure. For example, a paraffin and a naphthene, each boiling at 142° C. at a pressure of 1 atmosphere, may have boiling points of about 100 and 98° C., respectively, at a pressure near 200 mm. mercury (Hg.); and a mixture of these two hydrocarbons, quite unseparable by distillation at atmospheric pressure, can be readily separated at the reduced pressure by distillation in an efficient column.[63] Such a procedure of altering the pressure was effectively employed as the "keystone" in bringing about the separation of two hydrocarbons occurring in the "methyloctane" fraction of petroleum, viz., an unidentified paraffin and an unidentified naphthene (each of nine carbon atoms) normally boiling at 140.8 and 141.2° C., respectively.[63]

Distillation in the presence of an appropriate azeotrope-forming added substance is also very effective in separating constant-boiling mixtures. If the constant-boiling mixture is already an azeotropic mixture, the added substance is one that forms a new azeotropic mixture with one of the components of the original mixture. If the constant-boiling mixture is one composed of several nearly ideal constituents having about the same boiling point, the added substance is one which forms an azeotropic mixture with one of the original components. As a matter of practical convenience, the substance added must be one that is itself readily removed, as by extraction with water, from the hydrocarbon with which it has formed the azeotropic mixture. This method of distillation with an azeotrope-forming substance has been used effectively to separate, with methyl or ethyl alcohol,[8, 11] the nearly constant-boiling mixture of normal hexane and benzene; to separate certain constant-boiling mixtures of paraffin and naphthene hydrocarbons with acetic acid[60, 62]; and, most effectively, to separate, with acetic acid, the aromatic hydrocarbons from the paraffins and naphthenes, in that part of the gasoline fraction normally boiling between 154 and 62° C.[62]

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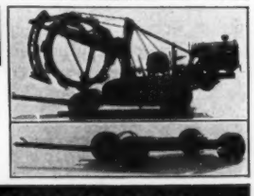

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volatile fractions of petroleum because of their tendency to decompose when heated for long periods of time at their normal boiling temperatures. For such material, the available range of pressures for distillation becomes correspondingly limited. Several types of apparatus for distilling the lubricant fractions of petroleum under high vacuum have been used by the project.[1, 43, 100]

3. Crystallization

Crystallization by simple refrigeration is especially useful in separating a component which is present in large amount (such as a normal paraffin previously concentrated by distillation) from a mixture which crystallizes on cooling. A convenient and effective method to use in this case is that of equilibrium melting: the entire cut is first solidified and thoroughly mixed (as a slush) to secure homogeneity; and then, as the temperature is raised, most of the impurities are centrifuged off as a liquid from the more or less pure crystals of the wanted hydrocarbon. Repeated fractionation in this manner produces hydrocarbons of extremely high purity. This method of fractionation has been a most important one in the work of the project, and several types of apparatus have been described.[10, 18]

The method of crystallization from a solvent is used when the given mixture contains no one hydrocarbon in large amount, and when the fluidity is so low that the mixture solidifies to a glass on cooling. To provide for the crystallization of the wanted component, its mobility in the liquid state is increased by dissolving it in a suitable liquid solvent. The solvent must be one that remains fluid at the operating temperatures, and that is easily removed—as by simple evaporation—from the hydrocarbon mixture. Several types of apparatus for this method of fractionation have been devised by the project, using as solvents methane, ethane, propane, ethylene, dichlorodifluoromethane, dimethyl, ether, and ethylene chloride.[26, 32, 36, 43]

4. Extraction

Fractionation by extraction is accomplished by using an appropriate liquid solvent in which the constituents of the given mixture will distribute themselves in proportions differing from those which they had in the original mixture. Several types of laboratory extraction apparatus have been developed by the project, for fractionating both the gasoline and the lubricant fractions of petroleum;‡ and included among the solvents used for this purpose are sulfur dioxide, aniline, acetic acid, acetone, and methyl cyanide.[11, 19, 45, 48, 69, 73]

5. Adsorption

By means of adsorption with silica gel, it has been found possible to remove effectively the aromatic hydrocarbons from a mixture of these with paraffin and naphthene hydrocarbons. Although the capacity of the gel is small, the removal of the aromatic constituents can be made practically complete. Adsorption with silica gel also effects a small but significant separation of naphthenes from paraffin hydrocarbons. A simple type of apparatus has been devised for these fractionations.[46]

6. Controlled Chemical Treatment

It sometimes happens that it is difficult to effect the final purification of a given hydrocarbon by purely physical means; and, in this case, carefully-controlled chemical treatment may serve to remove the last impurities. An example of this is the use of chlorosulfonic acid to prepare "best" samples of the lower-boiling normal paraffins.[37, 96]

If two isomers having boiling points very near to each other are present together in a final fraction in amounts which nearly corresponds to the composition of their eutectic mixture, separation by distillation and crystallization will be extremely difficult. In this case the separation may be effected by chemical treatment if there is found a simple chemical reaction or reactions which will preferentially remove one of the constituents. An example of this is the use of sulfonation, with subsequent hydrolysis at an appropriate temperature to recover the hydrocarbon, to separate metaxylene from paraxylene, ethylbenzene from the xylenes, and mesitylene from pseudocumene.[23, 27, 53]

In some of the earlier work the aromatic hydrocarbons benzene and toluene were removed from their mixtures with paraffin and naphthene hydrocarbons by carefully-controlled nitration to form 1,3-dinitrobenzene and 2,4-dinitrotoluene, respectively. However, such separations can now be carried out effectively by the purely physical methods recently developed for separating aromatic hydrocarbons from paraffins and naphthenes by adsorption with silica gel[46] or by distillation with acetic acid.[52, 62]

7. Schematic Outline of the System of Fractionation

In Figure 1 is given a schematic outline of the manner in which the foregoing principles and processes are applied in the systematic fractionation of the gasoline or kerosene fractions of a given crude petroleum in order to separate the material into its significant constituents. The same general method would also be applicable to any narrower cut of petroleum in this range of volatility. Much of the success of a given separation depends upon the judicious selection of the order in which the appropriate processes of fractionation are carried out. It can be said, in general, that in separating pure hydrocarbons from the gasoline fraction of petroleum the normal paraffins are least difficult, the aromatics next, with the branched-chain paraffins and the naphthenes being the most difficult to separate.

In connection with the separation of the lubricant fraction into its significant constituents, or into final fractions which are homogeneous with respect to size and type of molecules, the procedure is in general similar to that employed for the volatile fractions as given above. However, the work of separating the lubricant fraction is very much more difficult for the following reasons:

(a) The distilling processes are limited to those at exceedingly low pressures because of the tendency of hydrocarbons of high molecular weight to decompose at their normal boiling temperatures.

(b) The number of constituents is very much greater than in the fractions of low molecular

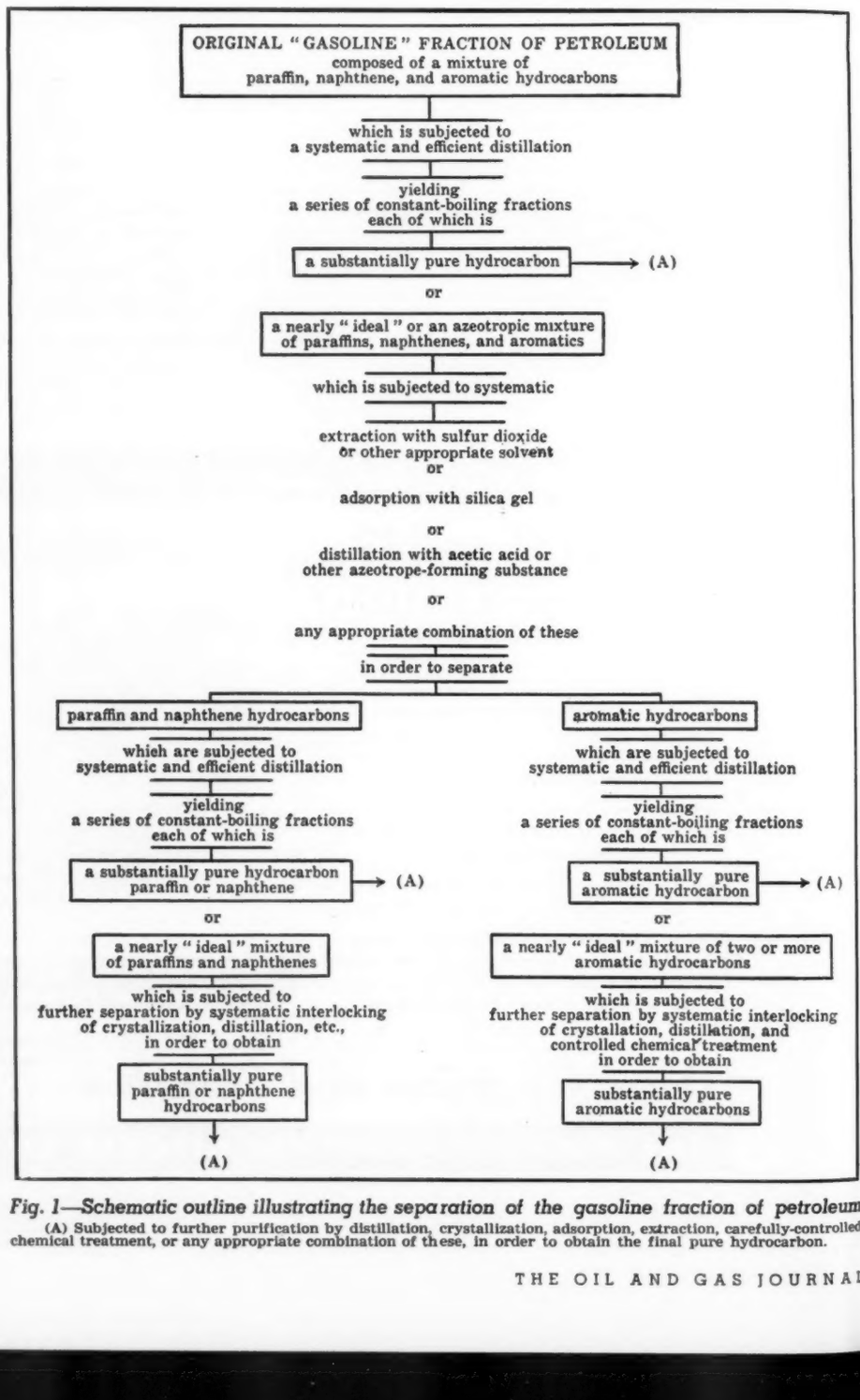

Fig. 1—Schematic outline illustrating the separation of the gasoline fraction of petroleum

(A) Subjected to further purification by distillation, crystallization, adsorption, extraction, carefully-controlled chemical treatment, or any appropriate combination of these, in order to obtain the final pure hydrocarbon.

‡See also Cannon and Fenske.[107]

weight and, consequently, a correspondingly larger quantity of original material must be obtained if the separation of pure hydrocarbons is aimed at.

In Figure 2 is shown a schematic outline of a method which may be employed in separating the lubricant fraction of petroleum into its significant constituents, or at least into final fractions which are homogeneous with respect to the type and size of molecules.[42, 43]

Methods of Identification

After a substantially pure compound has been separated from petroleum, it becomes necessary to record all of the important properties of a purified "best" sample and, where possible, to identify the compound by comparison of these properties with those of appropriate synthetic compounds of known structure. The number of different physicochemical properties which are employed for the purpose of identifying a given substance should be as large as is practicable, in order to leave no reasonable doubt as to the conclusions which may be drawn. Washburn[6] has discussed the necessary criteria which must be satisfied in determining whether a given fraction is a pure substance.

In those cases where, because of the lack of material, the separation is forced to stop at the stage of "homogeneous" fractions containing molecules of about the same size and type, measurements of all the appropriate physicochemical properties may be made, and the results correlated with the properties of pure hydrocarbons of known structure in order to ascertain the type of molecule contained in the given fractions.

1. Important Physicochemical Properties

The physicochemical properties which are considered important by the project for purposes of record and identification are the following: boiling point (at an appropriate pressure), freezing point, density, refractive index, molecular weight, carbon and hydrogen composition, critical solution temperature in aniline or aniline point, viscosity, and infrared (1 to 2 μ) absorption spectrum. In addition to these properties—most of which, but usually not all, are determined on all the final fractions—it is sometimes desirable to determine values of the refractive dispersion and optical rotation, and to obtain photomicrographs of the crystals. As time goes on, there will likely be added to the above list other characteristic properties, including surface tension, ultraviolet absorption, for infrared absorption, X-ray diffraction patterns, heat of fusion, etc., as these become readily and accurately measurable and significant for identification of structure.

2. Boiling Point

The boiling point is one of the most commonly used properties of organic liquids. In general, the boiling point increases with molecular weight, for a given type of compound; and, for the three classes of hydrocarbons in the gasoline fraction of petroleum—paraffins, naphthenes and aromatics—molecules with about the same number ($\pm$ 1) of carbon atoms will usually be found in the same boiling range. For a pure substance, the accurate determination of the boiling point requires that there be thermodynamic equilibrium between the liquid and vapor; that the thermometer be at the same temperature as the liquid and vapor; and that the pressure at the place where the temperature is determined be accurately known. For the most accurate determinations of the boiling points, a platinum resistance thermometer is used, together with an apparatus having a boiler of the Cottrell, Washburn, or Swietoslawski types.[8, 20, 97, 98, 99, 103] Apparatus of special type is required to determine the boiling points of hydrocarbons of high molecular weight at low pressures (near 1 mm. mercury).[38]

(Continued on Next Page)

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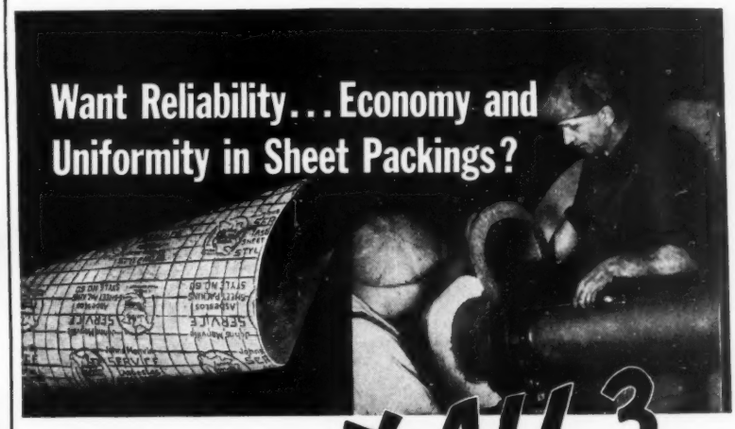

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3. Freezing Point

The freezing point is an important property for the identification of a substantially pure substance because of its uniqueness in having no uniform variation with type or with size of molecules. While the freezing point may, under certain conditions, be said to increase with molecular weight, the influence of the symmetry of the molecule on the freezing point is so marked as to prevent any broad generalizations along these lines being made, except for molecules of the same type and degree of symmetry (see the data in Table 1).

In determining the freezing point experimentally, care must be exercised to obtain equilibrium between crystals and liquid; and an accurate thermometer, preferably a platinum resistance one, should be used. For an absolutely pure substance, the time-temperature curve obtained in the freezing experiment will be horizontal at constant temperature during the time the two phases are in thermodynamic equilibrium. If the substance contains some impurity which is soluble in the liquid and insoluble in the solid, the initial freezing point will be depressed, and the slope of the "flat" will be increased, by an amount roughly proportional to the amount of impurity. If the heat of fusion of the substance is known, the difference between the initial freezing point and the temperature at which a known fraction of the material is frozen can be utilized to estimate the amount of liquid-soluble and solid-insoluble impurity in the sample.[96, 105] If the material is a mixture of constituents in amounts corresponding to the composition of the eutectic, the time-temperature curve will show a perfect "flat" for the duration of the freezing time; but the substance will not, except as an extremely remote possibility, be an exactly constant-boiling one.[97, 98]

The apparatus and procedure used by the project for determining freezing points and freezing curves are simple but effective.[5, 73]

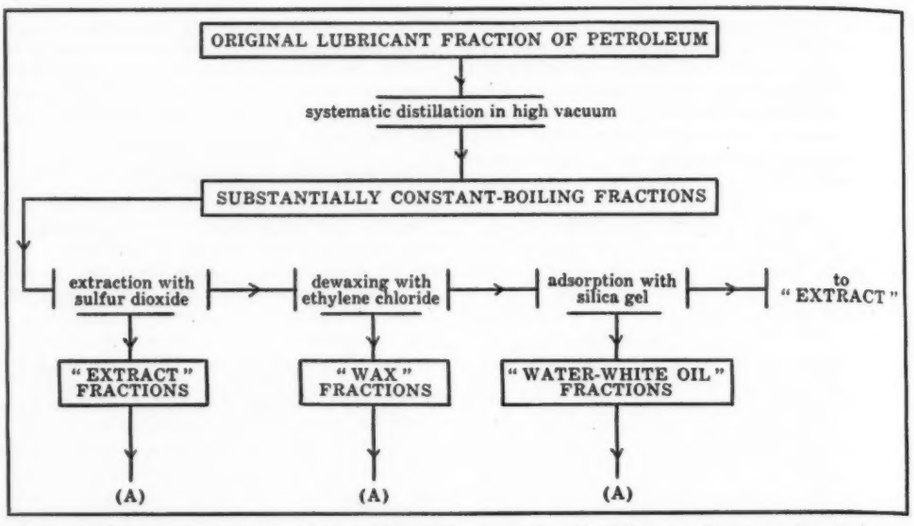


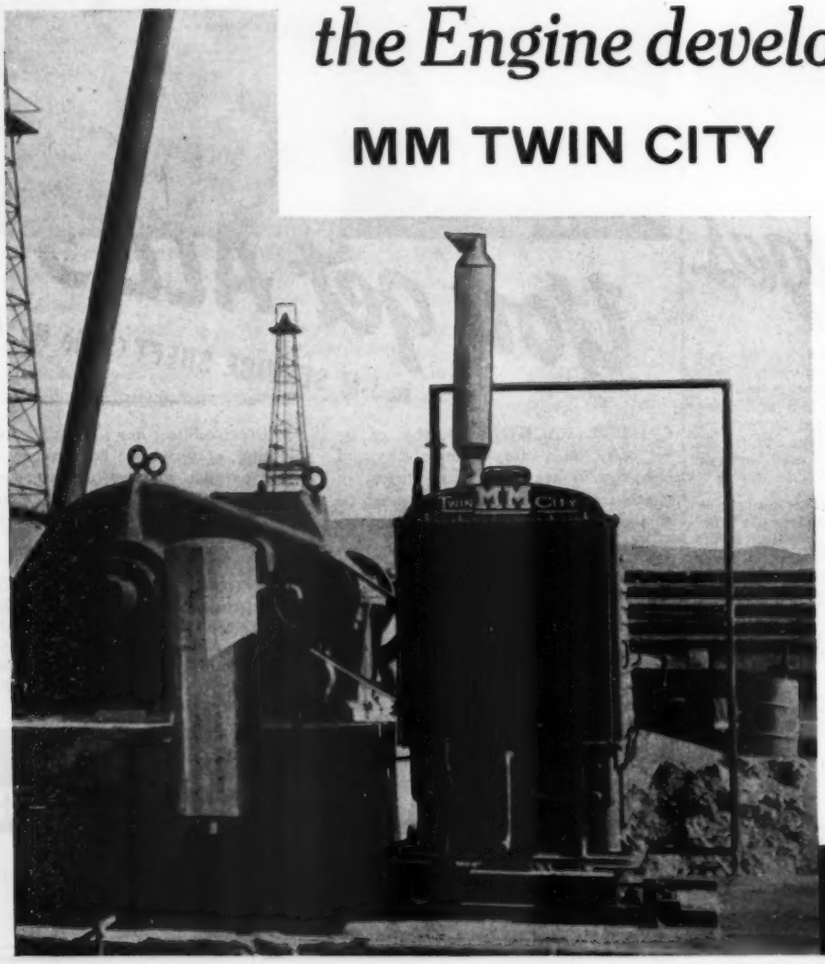
Fig. 2—Schematic outline of the method of separating the lubricant fraction of petroleum

(A) Subjected to a second systematic distillation in high vacuum in order to separate the material according to size of molecules or molecular weight. Following this, each of the substantially constant-boiling fractions is subjected to an extended interlocking separation by extraction, crystallization, adsorption, and distillation, in appropriate combination, in order to obtain "homogeneous" cuts containing molecules of substantially similar size and type, and, if sufficient material is available, to obtain pure hydrocarbons of high molecular weight.

4. Density and Refractive Index

The properties of density and refractive index are important ones, because they are characteristic of the type of molecule and can be measured easily with standard apparatus. The values of both density and refractive index increase in the order paraffin, naphthene, and aromatic; and, for molecules with 8 or 9 carbon atoms, have the following approximate values, respectively: density, 0.71, 0.77, 0.87; refractive index, 1.40, 1.425, 1.50.

Important properties involving both the refractive index and the density are the specific refraction and the specific dispersion, the latter property being the difference in the specific refraction for two given wave lengths of light. Each of these properties is characteristic of the different types of molecules and of their content of paraffin, naphthene, aromatic, and olefinic groups.[77, 88] For molecules with about 24 carbon atoms, the Lorenz-



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Lorenz specific refraction,¶ calculated for the D line, $\frac{1}{d}\left(\frac{n_D^2-1}{n_D^2+2}\right)$ has the following approximate values: one-ring aromatics, 0.3313; paraffins, 0.3345; naphthenes, 0.3345 — (0.0045) (number of rings). In this case, each naphthene ring produces a substantially constant decrease of about 0.0045 in the specific refraction. On the other hand, for the same molecules, the Lorenz-Lorenz specific dispersion, calculated for the G and C lines, $\frac{1}{d}\left[\frac{(n_G^2-1)}{(n_G^2+2)}-\frac{(n_C^2-1)}{(n_C^2+2)}\right]$ has the following approximate values: one-ring aromatics, 0.0150; paraffins, 0.0081_6; naphthenes, $0.0081_6 - (0.0001_3)$ (number of rings). In this case, each naphthene ring produces a substantially constant decrease of about 0.0001_3 in the specific dispersion.

As is pointed out later, the properties of refractive index and density, and various combinations of them, [77, 89, 95] are especially useful in classifying hydrocarbons broadly according to type and, in some cases, even in distinguishing between various possible isomers.[60]

5. Critical Solution Temperature in Aniline and Aniline Point

The critical solution temperature in aniline is another property which is broadly a function of the type of molecule, although for each class of hydrocarbons there is usually a gradual increase in its value with an increase in the number of carbon atoms in the molecule. In this connection, there should be distinguished the critical solution temperature in aniline, which is the maximum temperature (of all compositions) at which two phases coexist, from the usually not greatly different aniline point, which is the maximum temperature at which two phases coexist for the special composition of 50 per cent by volume each of oil and aniline. The critical solution temperature in aniline increases in the order aromatic, naphthene and paraffin; and, for molecules with about eight carbon atoms, has the following approximate values, respectively: —20, 45 and 70° C.

6. Molecular Weight

A knowledge of the molecular weight and of the carbon and hydrogen content of a given hydrocarbon is indispensable for record and identification. Combination of the values of these two properties with the atomic weights of carbon and hydrogen permits calculation of the molecular formula, C_nH_{2n+x}.

For determining the molecular weights of volatile hydrocarbons, the project has used variously a modified Victor-Meyer apparatus[6] and the method of freezing-point depression.[36] For determining the molecular weights of nonvolatile fractions, an accurate differential ebullioscopic apparatus, involving determination of the boiling-point elevation of an appropriate solvent, has been developed.[27]

7. Carbon and Hydrogen Content

The determination of the carbon and hydrogen content is made by burning the hydrocarbon in an atmosphere of oxygen and collecting the water and the carbon dioxide produced in weighted absorption tubes. Given the molecular weight,[7] the ratio of the mass of water to the mass of carbon dioxide produced in the combustion must be determined accurately in order to obtain a precise knowledge of the value of x in the formula C_nH_{2n+x}.

With the apparatus which has been developed at the National Bureau of Standards[1, 70, 71, 72] it is possible to determine, for gaseous, volatile and nonvolatile liquid, and solid hydrocarbons, the ratio of the mass of water to the mass of carbon dioxide produced in the combustion, with an uncertainty ranging in various cases from 2 to 5 parts in 10,000. For a pure hydrocarbon that contains about 14 per

¶In these formulas, n is the refractive index for the given wave length and d is the density. For the D, G and C lines, λ = 5,893, 4,341 and 6,563 A°, respectively (see Waterman et al,[77, 89] and also Mair and Willingham[60]).

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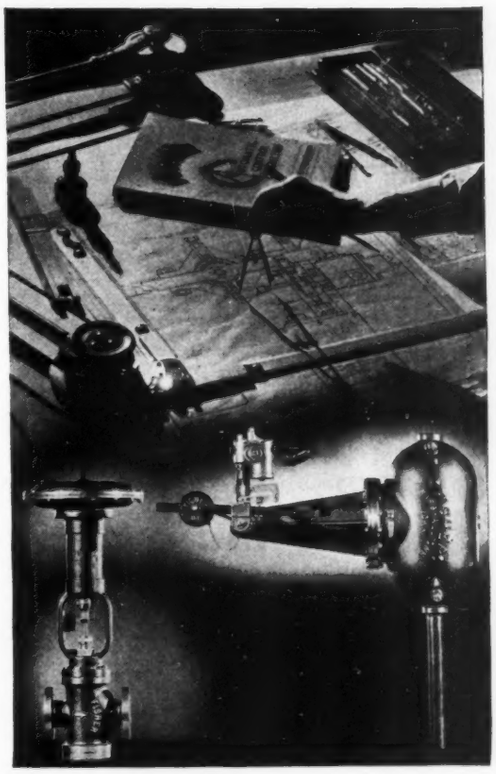

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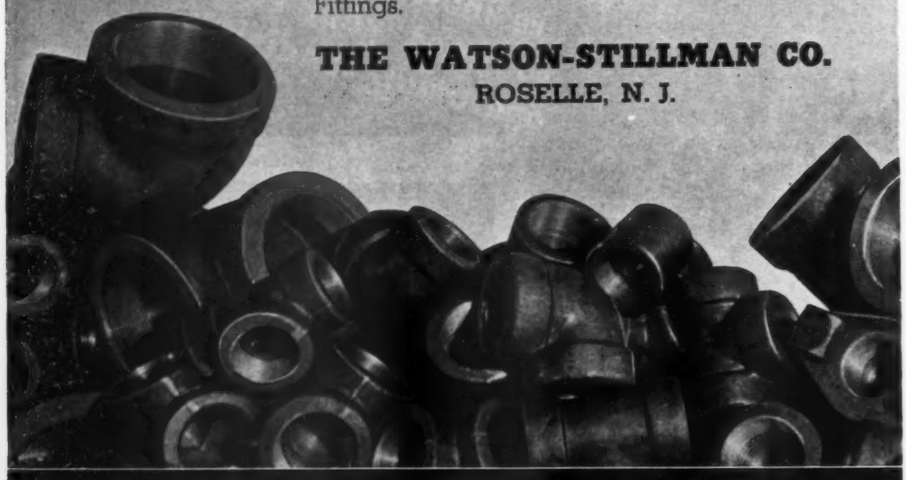

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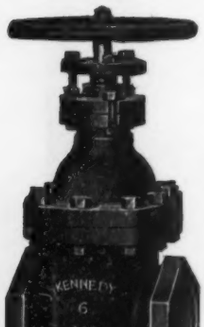

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cent by weight of hydrogen, an uncertainty of 5 parts in 10,000 in the ratio of the mass of water to the mass of carbon dioxide corresponds to an uncertainty of about ± 0.007 per cent by weight of hydrogen, or to an uncertainty in the value of x (in the formula C_nH_{2n+x}) of ± 0.007 and ± 0.03 for molecules of 7 and 30 carbon atoms, respectively.

In order to obtain such a high accuracy, it is necessary to have glass-to-glass connections,[1] to follow a careful procedure in preparing and manipulating the absorption tubes, and to make certain important corrections to the observed increases in weight.[70, 71] These latter corrections can be made less important by weighing the tubes always filled with hydrogen gas.[70] In determining the water and carbon dioxide, two absorption tubes are used in series—the first containing anhydrous, or slightly hydrated, magnesium perchlorate to absorb the water; and the second containing "Ascarite," a prepared mixture of sodium hydroxide and asbestos, to absorb the carbon dioxide. Both tubes contain at the exit end phosphorus pentoxide, and the gases entering the reaction zone are purified with the same reagents in the order "Ascarite," magnesium perchlorate, and phosphorus pentoxide—the oxygen to be used for combustion being first passed through a preheater for removing combustible material.

If the material being analyzed contains sulfur and nitrogen, as in the case of the "sulfur-dioxide-soluble" portion of the lubricant fraction, special reagents and precautions are employed to remove the oxides of sulfur and nitrogen from the products of combustion before they enter the absorption tubes.[73]

8. Infrared Absorption Spectra

The infrared absorption spectra have been recorded in the region of wave lengths from about 1 to 2μ (actually 11,200 to 18,500 A° or 8,900 to 5,400 cm^{-1}) where the *C-H* vibrations are active, for all the hydrocarbons which have been separated from petroleum by the project, and for a number of other pure hydrocarbons. Altogether, the project has now recorded, through the material cooperation of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, the infrared absorption in the regions 5,400 to 8,900 cm^{-1} for 55 different hydrocarbons, including paraffins, naphthenes, and aromatics, ranging in size from 5 to 36 carbon atoms per molecule.[28, 64]

Until this year these infrared data were used only as "fingerprints" for record and, in a qualitative way, to make a number of distinctions between the spectra of different types of molecules. In order to make this property more effective and useful, the project has recently completed a quantitative analysis, with respect to the component structural groups, $-CH_3$, $>CH_2$, $\equiv CH$, and $>CH$ (aromatic), of the infrared molal absorptive indices for these 55 hydrocarbons in the given regions of wave length.[67] From the data on the known hydrocarbons, values of the absorption coefficient for the various individual structural groups at appropriate wave lengths have been calculated. Combination of these values with the molal absorption actually measured at the given wave lengths for an unknown hydrocarbon permits calculation of the number, n_a, n_b, n_c, and n_d, respectively, of $-CH_3$, $>CH_2$ $\equiv CH$, and $>CH$ (aromatic) groups in the unknown hydrocarbon. Since the molecular weight and the carbon and hydrogen content of the unknown hydrocarbon permit one to compute its molecular formula, C_nH_{2n+x}, the values so found for n_a, n_b, n_c, and n_d must further satisfy the following conditions:

$$n_a + n_b + n_c + n_d \leq n \quad (1)$$

$$3n_a + 2n_b + n_c + n_d = 2n + x \quad (2)$$

The fact that the sum of n_a, n_b, n_c, and n_d may sometimes be less than n (the total number of carbon atoms in the molecule) is due to the possibility of there being in the molecule one or more carbon atoms, having attached to them no hydrogen atoms.

In applying this method of analysis to the de-

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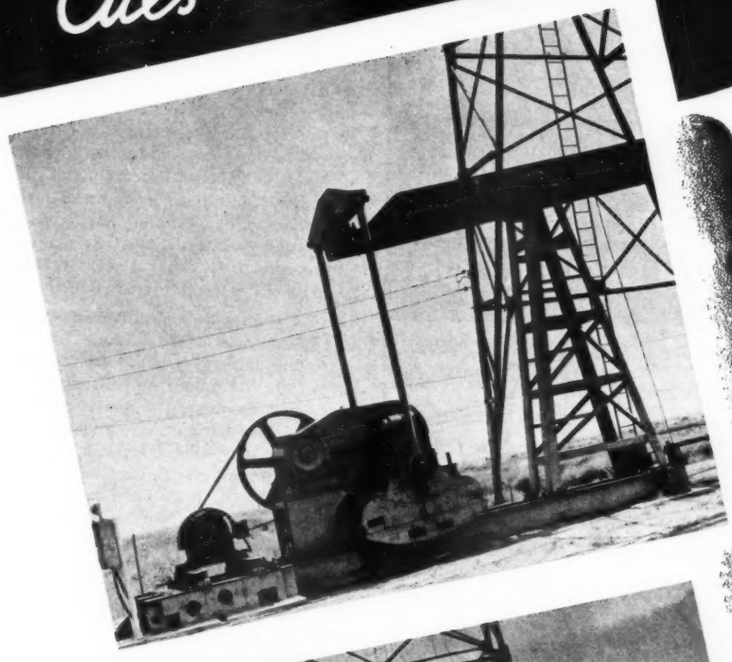

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termination of the number and kind of structural groups in an unknown hydrocarbon, the following procedure is used:[87]

(a) Measurement is made of the transmission of the unknown hydrocarbon in solution in carbon tetrachloride, for the regions of wave length 5,400 to 7,400 cm^{-1} and 7,900 to 8,900 cm^{-1}, with the concentration of the hydrocarbon so adjusted as to give a transmission of from 40 to 60 per cent in the given region.[28]

(b) The transmission curves so obtained experimentally are reduced to curves of the molal absorptive index, using the relation:

$$k = \left(\frac{1}{cd}\right) log \left(\frac{I_o}{I}\right)$$

where: I_o and I are, respectively, the intensities of the incident and transmitted light; c is the concentration of the hydrocarbon in moles per liter of solution; d is the length in centimeters of the cell through which the light passes; and k is defined as the molal absorptive index.[28]

(c) For the given wave lengths selected for determining the various structural groups, values of the molal absorptive index are recorded for the unknown hydrocarbon.

(d) Combination of these experimental values of k with the values of the unit coefficients of absorption for the various groups at the appropriate wave lengths yields a series of simultaneous equations of the form:

$$k = n_aA + n_bB + n_cC + n_dD \qquad (4)$$

where: k, A, B, C and D are known and n_a, n_b, n_c, and n_d are to be determined.

(e) The given simultaneous equations are solved for n_a, n_b, n_c, and n_d, respectively, the number of $-CH_3$, $>CH_2$, $\equiv CH$ and $>CH$ (aromatic) groups in the unknown molecule, and to each value an estimated uncertainty is assigned.

(f) The values obtained for n_a, n_b, n_c, n_d are correlated with the molecular formula, C_nH_{2n+x}, according to the above equations (1) and (2).

From present indications, it appears that the above method of analysis will prove to be extremely useful in the elucidation of the component structural groups of paraffin, naphthene, and aromatic hydrocarbons which cannot be identified on the basis of the other physicochemical properties because of the lack of data on appropriate synthetic hydrocarbons of known structure.

9. Photomicrographs of Crystals

An apparatus was developed for taking photomicrographs of crystals of hydrocarbons at low temperatures, and such photographs were obtained of crystals of various final fractions separated from that portion of petroleum normally boiling between 115 and 124° C., and of 28 known pure hydrocarbons (9 aromatics, 6 naphthenes, and 13 paraffins).[47, 61] From these studies it is concluded that condensed molecules tend to form nearly equidimensional polyhedrons while open-chain molecules tend to form elongated prisms; that molecules containing both condensed groups and open chains tend to form crystals of intermediate structure; that successive members of the series of normal paraffins cannot be distinguished by the appearance of their crystals; and that hydrocarbons of different types may sometimes bear a superficial resemblance.[61] The appearance of the crystal forms as shown by photomicrographs of crystals can be utilized in conjunction with other properties to identify the main constituents in mixtures of hydrocarbons.

10. Use of Physicochemical Properties in Characterizing Mixtures of Hydrocarbons

In any discussion of the use of physicochemical properties for record and identification, it is important to point out the use of such properties in broadly classifying a more or less closely fractionated cut of petroleum. For such correlation, a number of functions or combinations involving two or more properties have been developed by various investigators, and these methods have been strikingly successful in characterizing a mixture of petroleum hydrocarbons with respect to their "average" chemical constitution or the "predominating" constituents. Some of the combinations of properties used in this manner are: viscosity and density[74, 84]; molecular volume and molecular weight[75]; refractive index and molecular weight[76]; viscosity and temperature[78, 79, 80]; density and boiling point[81, 82]; viscosity and boiling point[83]; molecular volume and surface tension[85, 86]; refractive dispersion and molecular weight[88]; aniline point and density or molecular weight[89, 90, 91, 92, 93, 94]; refractive index and density[95]; specific refraction and molecular weight.[77]

Use of some of the above functions has been made by the project in connection with the determination of the chemical constituents of "homogeneous" fractions of "water-white" oil separated from the lubricant fraction of petroleum.[49]

Procedure Followed in Separating a Mid-Continent Petroleum

As pointed out in the introduction of this paper, the work of the project was to be carried on systematically on one representative crude petroleum, whose composition would be expected to lie between the extremes of Pennsylvania crude on the one hand and California or Gulf Coast crudes on the other. Accordingly there was obtained, through the courtesy of the Marland Oil Co. (now part of the Continental Oil Co.) a large uncontaminated sample of a Mid-Continent crude from well No. 6 of the South Ponca field in Kay County, Oklahoma. The Engler distillation of the original crude as given by the Marland Oil Co. is as follows[1, 22]: naphtha, 38.9 per cent; kerosene, 15.4 per cent; gas oil, 16.0 per cent; wax distillate, 18.1 per cent; bottoms, 10.2 per cent. A 600-gal. lot of this oil was first distilled in a semicommercial column by the Sun Oil Co., and the fractions were sent to the National Bureau of Standards. At the laboratory the ma-

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terial was divided into five lots, as received from the refinery, running from the low- to the high-boiling material:

1. 49.8 per cent, represented by about 258 gal. in 73 cuts.
2. 20.5 per cent, represented by about 110 gal. in 31 cuts.
3. 13.8 per cent, represented by about 36 gal. in 22 cuts.
4. 10.0 per cent, represented by about 20 gal. in 16 cuts.
5. 5.9 per cent, residue, represented by about 10.8 gal.

1. Gasoline Fraction

In the laboratory of the project, the above lot 1, including the naphtha fraction and the lower-boiling end of the kerosine fraction, was distilled in a 15-liter metal still provided with a 20-plate column,[1] and subsequently a number of times in 30-plate all-glass rectifying columns.[14] Cuts of nearly constant boiling points were obtained, and further separation by distillation in the then best columns available was no longer practicable, except for that portion normally boiling below 65° C. For the purpose of systematic operation by the several research groups of the project, the following broad classification of fractions was made, according to the normal boiling point of the material: 55-100° C.; 100-130° C.; 130-160° C.; 160-180° C. The higher-boiling fractions were placed in storage.

In separating this material into its constituents, the more or less constant-boiling fractions were subjected to a systematic and interlocking system of fractionation, substantially along the lines indicated by the schematic diagram of Figure 1. From the material boiling in the range 55-180° C., the following hydrocarbons were separated, substantially by a systematic combination of the fractionating processes indicated:

2,3-Dimethylbutane; boiling point, 58.0° C.

2-Methylpentane; boiling point, 60.3° C.
3-Methylpentane; boiling point, 63.3° C.
n-Hexane; boiling point, 68.7° C.

Separated by straight distillation, distillation with methyl and ethyl alcohols, and crystallization with equilibrium melting. Purity** of best samples over 95, 95, 95, and 98 mole per cent, respectively.[6, 11]

Methylcyclopentane; boiling point, 71.9° C.

Separated by straight distillation, controlled nitration to remove benzene,†† crystallization with equilibrium melting, and distillation with methyl alcohol. Purity of best sample 98.7 mole per cent.[13]

2,2-Dimethylpentane; boiling point, 78.9° C.

Separated by straight distillation and crystallization with equilibrium melting. Isolated as a mixture of 54 mole per cent of 2,2-dimethylpentane with 46 mole per cent of cyclohexane.[20]

Benzene; boiling point, 80.1° C.

Separated by straight distillation, extraction with aniline, and crystallization with equilibrium melting. Total amount of benzene removed from other fractions by controlled nitration.†† Purity of best sample 99.8 mole per cent.[11]

Cyclohexane; boiling point, 80.8° C.

Separated by straight distillation, controlled nitration to remove benzene,†† and crystallization with equilibrium melting. Purity of best sample 99.96 mole per cent.[12]

1,1-Dimethylcyclopentane; boiling point, 87.5° C.

Separated by straight distillation and controlled nitration to remove benzene.‡‡ Purity of best sample 95 mole per cent.[25]

2-Methylhexane; boiling point, 90.0° C.

Separated by straight distillation and crystallization from liquid methane plus propane. Purity of best sample 99.9 mole per cent.[25]

3-Methylhexane; boiling point, 91.8° C.

Separation not yet completed.

n-Heptane; boiling point, 98.4° C.
Methylcyclohexane; boiling point, 100.8° C.

Separated by straight distillation, controlled nitration to remove toluene,‡‡ and crystallization with equilibrium melting. Purity of best samples 99.8 and 99.8 mole per cent, respectively.[17]

Toluene; boiling point, 110.6° C.

Fractionated by straight distillation. Amount present determined by controlled nitration.‡‡ None actually isolated.[9]

2-Methylheptane; boiling point, 117.2° C.

Separated by straight distillation and crystallization from liquid methane plus propane. Purity of best sample 97 mole per cent.[26]

Octanaphthene; boiling point, 119.8° C.
1,3-Dimethylcyclohexane; boiling point, 120.3°C.
Octanaphthene (1,2-dimethylcyclohexane ?); boiling point, 123.4° C.

Separated by straight distillation and crystallization from liquid methane plus propane. Purity of octanaphthene, boiling point, 119.8° C., not determined; purity of other two, 98 and 91 mole per cent, respectively.[39, 47]

n-Octane; boiling point, 125.6° C.

Separated by straight distillation and crystallization with equilibrium melting. Purity of best sample 99.1 mole per cent.[19]

**With several exceptions, the values of purity given in this section and in Table 2 have been estimated from the freezing curves.[45, 196]

‡‡See discussion on controlled chemical treatment. See page 196.

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Ethylcyclohexane; boiling point, 131.8° C.

Separated by straight distillation, extraction with sulfur dioxide, adsorption with silica gel, distillation with acetic acid, and crystallization from liquid methane plus propane. Purity of best sample 95 mole per cent.[41]

2,6-Dimethylheptane; boiling point, 135.2° C.

Separated by straight distillation, extraction with sulfur oioxide, adsorption with silica gel, distillation with acetic acid, and crystallization from liquid dichlorodifluoromethane. Purity of best sample 99 mole per cent.[56, 58]

Ethylbenzene; boiling point, 136.2° C.

Separated by straight distillation, extraction with sulfur dioxide, crystallization with equilibrium melting, and controlled sulfonation at 0° C. with subsequent preferential hydrolysis at 30° C. Purity of best sample 95 mole per cent.[27]

Nonanaphthene; boiling point, 136.7° C.

Separated by straight distillation, extraction with sulfur dioxide, crystallization from liquid methane plus propane, and crystallization from liquid dichlorodifluoromethane. Purity of best sample better than 99 mole per cent.[38]

p-Xylene; boiling point, 138.4° C.
m-Xylene; boiling point, 139.2° C.
o-Xylene; boiling point, 144.4° C.

Separated by straight distillation, extraction with liquid sulfur dioxide, and crystallization with equilibrium melting. The best sample of *m*-xylene was obtained by sulfonation at 0° C. with subsequent preferential hydrolysis at 130 to 135° C. Purity of best samples better than 99.9, 99.9, and 99 mole per cent, respectively.[23]

*Iso*nonane; boiling point, 140.8° C.
Nonanaphthene; boiling point, 141.2° C.

Separated by straight distillation, extraction with sulfur dioxide, adsorption with silica gel, distillation with acetic acid, distillation at reduced pressure, crystallization from dichlorodifluoromethane, and crystallization from liquid methane plus propane. Purity of best samples 85 and 95 mole per cent, respectively.[63]

4-Methyloctane; boiling point, 142.4° C.
2-Methyloctane; boiling point, 143.3° C.
3-Methyloctane; boiling point, 144.2° C.

Separated by straight distillation, extraction with sulfur dioxide, adsorption with silica gel, distillation with acetic acid, crystallization from dichlorodifluoromethane, and crystallization from liquid methane plus propane. Purity of best samples 80, 99.9, and 95 mole per cent, respectively.[65]

n-Nonane; boiling point, 150.7° C.

Separated by straight distillation and crystallization with equilibrium melting. Purity of best sample 99.9 mole per cent.[15]

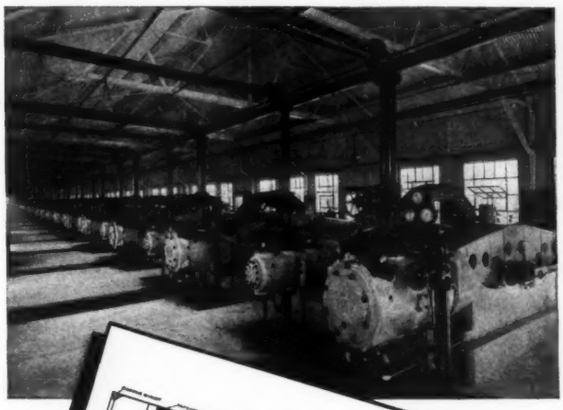
*Iso*propylbenzene; boiling point, 152.4° C.

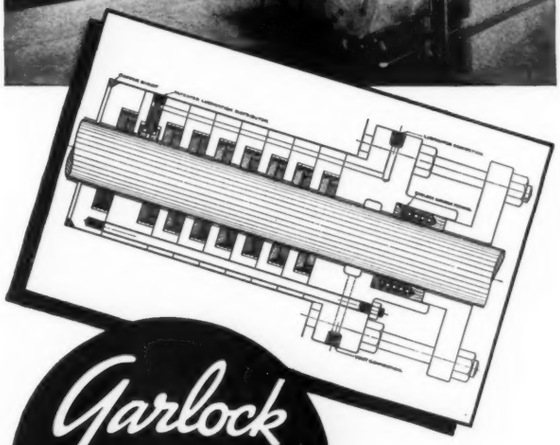
Separated by straight distillation, adsorption with silica gel, and distillation with acetic acid. Purity of best sample 98.4 mole per cent.[61]

1,3,5-Trimethylbenzene (mesitylene); boiling point, 164.6° C.
1,2,4-Trimethylbenzene (pseudocumene); boiling point, 169.2° C.
1,2,3-Trimethylbenzene (hemimellitene); boiling point, 176.1° C.

Separated by straight distillation, extraction with sulfur dioxide, extraction with sulfur dioxide plus petroleum ether at —40° C., crystallization from liquid dimethylether, and sulfonation with subsequent preferential hydrolysis to obtain best samples of mesitylene and hemimellitene. Purity of

(Continued on Page 209)





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best samples 99.95, 99.9, and 99.95 mole per cent, respectively.[32]

n-Decane; boiling point, 174.0° C.

Separated by straight distillation and crystallization with equilibrium melting. Purity of best sample better than 99.99 mole per cent.[18]

2. Lubricant Fraction

In 1933 it seemed desirable that, in view of its economic importance to the industry, some information be obtained on the lubricant fraction of petroleum before that material would be reached in the normal course of operation. Accordingly, one unit of the project began work on that part of this Mid-Continent petroleum listed on page 204 as Lot 4, which consisted of about 20 gallons of "lubricant" material representing 10 per cent of the original crude petroleum. Of this material there were, as obtained from a distillation in a semicommercial column by the Sun Oil Co., 16 cuts ranging in viscosity at 210° F. from 0.046 to 0.187 stokes (41 to 92 Saybolt seconds).

In the laboratory of the project, this material was then separated into three portions of about equal amounts but of distinctly different properties, substantially by the following procedure: First, an "extract" portion, by batch extraction with liquid sulfur dioxide at about 40° C. (104° F.); second, a "wax" portion, by dewaxing at —18° C. (0° F.) from solution in ethylene chloride; and, third, a "water-white" portion, by treatment of the remaining oil with silica gel.[43]

In this manner there were obtained from the original 67 kg. (20 gallons) of the lubricant fraction, representing 10 per cent of this Mid-Continent petroleum, the following three main portions, with the indicated properties for 100° F. (extrapolated from higher temperatures where necessary):

(a) "Extract" portion, 17.9 kg. in 15 cuts. Viscosity, from 1.9 to 384 stokes (880 to 178,000 Saybolt seconds). Density, from 0.95 to 1.07 g. per cc. Viscosity index, from —150 to —300.

(b) "Wax" portion, 20.3 kg. in 16 cuts. Viscosity, from 0.12 to 0.050 stoke (66 to 231 Saybolt seconds). Density, from 0.80 to 0.83 g. per cc. Viscosity index, from 125 to 150.

(c) "Water-white" portion, 19.8 kg. in 11 cuts. Viscosity, from 0.21 to 1.13 stokes (102 to 520 Saybolt seconds). Density, from 0.85 to 0.88 g. per cc. Viscosity index, 90 to 110.

The third or "water-white" oil portion was the material of greatest immediate interest and importance, and this oil was then subjected to a further separation.[45, 48] There was first carried out a systematic distillation in high vacuum, through eight stages, in order to obtain a series of substantially constant-boiling fractions in which the molecules would be distributed mainly according to their size or molecular weight.

There were obtained in this way 10.1 kg. of "water-white" oil in 22 substantially constant-boiling fractions, the material less viscous than 0.29 stoke (137 Saybolt seconds) and more viscous than 1.15 stokes (530 Saybolt seconds) at 100° F., being placed in storage. The properties of these 22 constant-boiling fractions ranged as follows: Viscosity at 100° F., from 0.29 to 1.15 stokes (137 to 530 Saybolt seconds); density at 100° F., from 0.85 to 0.86 g. per cc.; boiling point at 1 mm. mercury from about 200 to 280° C. (392 to 536° F.); viscosity index, from 100 to 92; number of carbon atoms per molecule, from about 27 for the first to 38 for the last fraction. The small change in density and viscosity index, and the large change in viscosity, boiling point, and molecular weight, between the first and last fractions indicated that the systematic distillation had done a fairly good job in separating the material according to size of molecule.

These fractions of substantially constant-boiling oil were then subjected to a separation with respect to type of molecule, by extended reflux extraction with acetone in columns 46 feet long.[48] The lowest-boiling fraction so treated yielded a series of about

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30 cuts with an almost constant value of 27.5 for the average number of carbon atoms per molecule, while the value of x in the formula C_nH_{2n+x} ranged from —9 for the most soluble to zero for the least soluble cut; and in this same series the density at 100° F. ranged from 0.90 to 0.82, the viscosity at 100° F. from 0.63 to 0.18 stoke (291 to 89 Saybolt seconds), the boiling point at 1 mm. mercury from 204 to 208° C. (399 to 406° F.), and the viscosity index from 36 to 149. For the highest-boiling fraction so extracted, the following properties were obtained as extremes for the most soluble and the least soluble, respectively, of the series of about 30 cuts obtained from it: Average number of carbon atoms per molecule, 38.4 and 36.8; value of x in the formula, C_nH_{2n+x}, —7.4 and —1.95; density at 100° F., 0.883 and 0.846 g. per cc.; viscosity at 100° F., 1.56 and 0.73 stokes (720 and 337 Saybolt seconds); boiling point at 1 mm. mercury, 270 and 275° C. (518 and 527° F.); viscosity index, 75 and 115.

The 10 kg. of "water-white" oil was thus separated into about 600 fractions of from 15 to 20 grams each, at which point the fractionation was stopped because of the lack of material. These fractions, each being about 1/40,000 part of the original crude petroleum, were extremely narrow cuts with respect to both types and size of molecules.[40]

Summary of the Results Obtained on the Naphtha Fraction

1. Hydrocarbons in the Naphtha Fraction

In Table 2 are listed, for that part of this Mid-Continent petroleum normally boiling below 180° C. (356° F.), the hydrocarbon constituents as determined by A.P.I. Research Project 6 to September 1, 1937. The columns in the table give, respectively, the number, molecular formula, name, boiling point at 1 atmosphere, purity of the best sample, estimated relative amount by volume in the crude, and reference to the research paper in which the given hydrocarbon is reported.

2. Estimated Amounts of the Hydrocarbons

In connection with the values which have been given for the estimated amount of a given hydrocarbon in the crude petroleum, it is important to note the following points:

(a) Compared with the actual isolation of the pure hydrocarbons, the estimation of the amount of a given hydrocarbon in the crude petroleum is of secondary importance, and is based upon the amounts of the hydrocarbon obtained in various degrees of estimated purity. Owing to the fact that a given lot of material may be subjected to many different processes of fractionation before the separation is successfully effected, considerable losses of material occur at various stages in the work. These operational losses take place over a period of years, and it is impossible to evaluate them accurately. Any values deduced for the estimated amount of a given hydrocarbon in the crude petroleum must, therefore, be considered to be roughly approximate and to give only the order of magnitude. The values for the estimated amount of a given hydrocarbon in the crude petroleum which have so far been published by the project have been based upon the original volume of the crude petroleum. However, even when allowance is made for immediate operational losses occurring in the separation of a given hydrocarbon, the foregoing procedure takes no cognizance of the general losses which have occurred over broad fractions of material during the years of processing.

(b) A more accurate quantitative measure of the amounts of the various hydrocarbons in this Mid-Continent petroleum can be obtained by carrying out, on a second lot of the original material, an "incomplete" separation, in which an accurate material balance is kept, and utilizing the results of the more complete and exhaustive separation already reported to interpret the data so obtained. The procedure would be as follows: First, the material would be distilled systematically in highly-efficient rectifying columns (keeping an accurate record of quantities of oil) in order to obtain a series of substantially constant-boiling fractions; second, appropriate tests would be made on these constant-boiling fractions, based upon the information already available from the exhaustive fractionation, in order to ascertain the composition of the given fractions; third, the data obtained in this "short-cut" method would be correlated with the data from the complete separation to yield more reliable values for the amounts of the hydrocarbons in this petroleum. A procedure such as this has already been applied to the naphtha fraction of Mid-Continent petroleum from the Ponca City field by Fenske and collaborators,[96, 101] and it is hoped that the results of this study will lead to more accurate values for the amounts of the various hydrocarbons in the crude.

(c) Pending further study of the problem of a more accurate evaluation of the actual amount of a given hydrocarbon in this crude petroleum, there are reported in Table 2 in the list of hydrocarbons in a Mid-Continent petroleum determined by A.P.I. Research Project 6, no values of the percentage amount of a given hydrocarbon in the crude petroleum, but values of the *estimated relative amounts, by volume, of the given hydrocarbons in the petroleums.* While any one of these values may be in error by as much as 50 to 100 per cent of itself, the uncertainties probably average out over the entire lot so as to give a fairly good quantitative picture of the relative amounts of the hydrocarbons in the crude or in the gasoline fraction. The values for normal octane and normal nonane, which appear rather definitely to be present in about equal amounts in this crude,[10, 16, 101] are each assigned a value of 1.0, and the others corresponding relative numbers. The order of magnitude of the amount of the given hydrocarbon in the original crude petroleum can be obtained by multiplying the numbers giving the relative amounts (in terms of normal octane or normal nonane) by a factor which may be roughly estimated, at this time, to be somewhere between 1 and 1⅔.

3. Number of Significant Constituents in Petroleum

Ever since the beginning of research on the chemical constitution of petroleum many decades ago, one of the most interesting but perplexing questions has been: "How many hydrocarbons are there in petroleum?" It is likely that this question can never be answered literally; but, from the work which has so far been done, a partial answer may now be given with respect to a large part of the gasoline fraction of Mid-Continent petroleum.

In Table 2 there are listed 45 hydrocarbons definitely known to be in that part of this petroleum normally boiling below 180° C. The question immediately arises as to how many more significant constituents there may be in this material. Since a large part of the material normally boiling between 145 and 180° C. remains to be resolved, the best results in the present analysis of the number of significant constituents is obtained by considering only the material normally boiling between 55 and 145° C. which material, on the basis of the present volume of unresolved fractions, appears to be over three-fourths assigned to individual hydrocarbons. Accordingly, there are listed in Table 3 the 31 hydrocarbons, taken in decreasing order of abundance, which have been separated from the fraction 55-145° C. (131-293° F.). The last two columns in Table 3 give, respectively, the relative amount of each hydrocarbon and the summation of the relative amounts.

As noted above, the amount of the fraction 55-145° C. which, on the basis of the present volume of the unresolved material, has been assigned to individual hydrocarbons is over 75 per cent. Assuming, then, that the summation value of 7.0 is 75 per cent of the total fraction, 100 per cent would be 9.3; and it follows, within the accuracy of these data and assumptions, that eight individual hydrocarbons constitute about one-half of the entire petroleum normally boiling between 55 and 145° C.

TABLE 2—HYDROCARBONS IN A MID-CONTINENT PETROLEUM AS DETERMINED BY AMERICAN PETROLEUM INSTITUTE RESEARCH PROJECT 6 AT THE NATIONAL BUREAU OF STANDARDS

(To September 1, 1937)

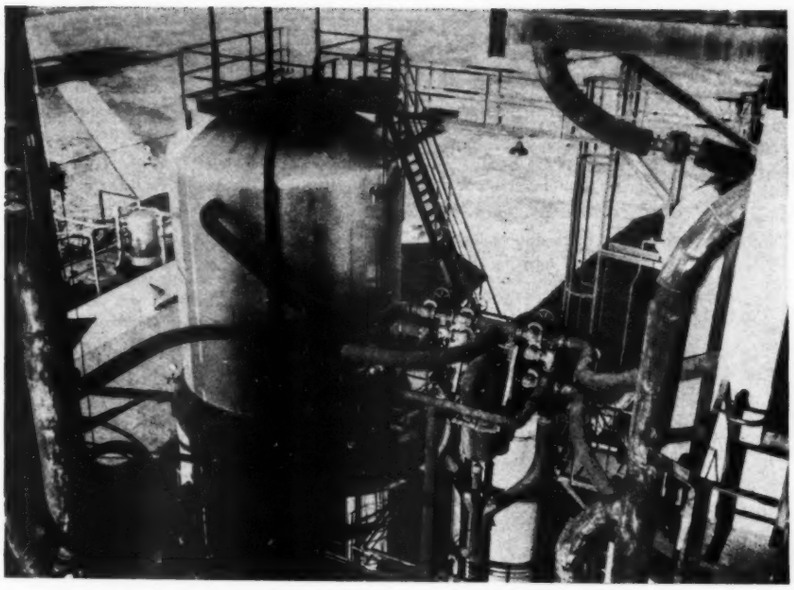
No.	Formula	Name and type of hydrocarbon—	Boiling point at 1 atmosphere (°C.)	Purity of best sample isolated (mole per cent)	Estimated relative amount by volume[a]	For description, see the following references[b]
		PARAFFINIC				
1	CH_4	Methane	—161.7	[c]	[c]	....
2	C_2H_6	Ethane	— 88.6	[c]	[c]	....
3	C_3H_8	Propane	— 42.2	[c]	[c]	....
4	C_4H_{10}	*Iso*butane	— 12.1	[c]	[c]	....
5	C_4H_{10}	*n*-Butane	— 0.5	[c]	[c]	....
6	C_5H_{12}	2-Methylbutane	27.9	[c]	[c]	....
7	C_5H_{12}	*n*-Pentane	36.1	[c]	[c]	....
8	C_6H_{14}	2,3-Dimethylbutane	58.0	>95.0	0.06	8, 11
9	C_6H_{14}	2-Methylpentane	60.3	>95.0	0.1_2	8, 11
10	C_6H_{14}	3-Methylpentane	63.3	>95.0	0.2_5	8, 11
11	C_6H_{14}	*n*-Hexane	68.7	98.3	0.7	8, 11
12	C_7H_{16}	2,2-Dimethylpentane	78.9	54.0	0.04	20
13	C_7H_{16}	2-Methylhexane	90.0	99.9	0.3_5	25
14	C_7H_{16}	3-Methylhexane	91.8	[d]	0.2	[d]
15	C_7H_{16}	*n*-Heptane	98.4	>99.8	1.1	17
16	C_8H_{18}	2-Methylheptane	117.2	97.0	0.5	26, 47
17	C_8H_{18}	*n*-Octane	125.6	99.1	1.0	10
18	C_9H_{20}	2,6-Dimethylheptane	135.2	>99.0	0.1	50, 58
19	C_9H_{20}	*Iso*nonane	140.8	85.0	0.05	63
20	C_9H_{20}	4-Methyloctane	142.4	80.0	0.06	55
21	C_9H_{20}	2-Methyloctane	143.3	99.9	0.2	55
22	C_9H_{20}	3-Methyloctane	144.2	95.0	0.06	55
23	C_9H_{20}	*n*-Nonane	150.7	99.9	1.0	15
24	$C_{10}H_{22}$	*n*-Decane	174.0	>99.99	0.8	18
		NAPHTHENIC				
25	C_5H_{10}	Cyclopentane	49.5	[c]	[c]	....
26	C_6H_{12}	Methylcyclopentane	71.9	98.7	0.2_5	13
27	C_6H_{12}	Cyclohexane	80.8	99.96	0.3_5	12
28	C_7H_{14}	1,1-Dimethylcyclopentane	87.5	95.0	0.05	25
29	C_7H_{14}	Methylcyclohexane	100.8	>99.8	0.3_5	17
30	C_8H_{16}	Octanaphthene	119.8	[c]		{ 47
31	C_8H_{16}	1,3-Dimethylcyclohexane	120.3	98.0	0.2	{ 39, 47
32	C_8H_{16}	Octanaphthene (1,2-dimethylcyclohexane?)	123.4	91.0	0.04	47
33	C_8H_{16}	Ethylcyclohexane	131.8	95.0	0.1	41
34	C_9H_{18}	Nonanaphthene (alkyl cyclopentane)	136.7	>99.0	0.1	36
35	C_9H_{18}	Nonanaphthene	141.2	95.0	0.08	63
		AROMATIC				
36	C_6H_6	Benzene	80.1	99.8	0.08	11
37	C_7H_8	Toluene	110.6	[c]	0.3	9
38	C_8H_{10}	Ethylbenzene	136.2	95.0	0.03	27
39	C_8H_{10}	*p*-Xylene	138.4	>99.9	0.04	23
40	C_8H_{10}	*m*-Xylene	139.2	>99.9	0.1_2	23
41	C_8H_{10}	*o*-Xylene	144.4	>99.0	0.1_2	23
42	C_9H_{12}	*Iso*propylbenzene	152.4	98.4	0.03	61
43	C_9H_{12}	1,3,5-Trimethylbenzene (mesitylene)	164.6	99.95	0.02	32
44	C_9H_{12}	1,2,4-Trimethylbenzene (pseudocumene)	169.2	99.9	0.2	32
45	C_9H_{12}	1,2,3-Trimethylbenzene (hemimellitene)	176.1	99.95	0.06	32

[a] The numbers in this column give the estimated amounts by volume of the given hydrocarbon in the petroleum, referred to normal octane or normal nonane (which are present in substantially equal amounts) as unity. In order to obtain the order of magnitude of the *percentage content* of the given hydrocarbon in the original crude, these figures should be multiplied by a factor which is roughly estimated to be somewhere between 1 and 1⅔. (See text on this page.)

[b] See the list of publications of A.P.I. Research Project 6 on page 220.

[c] Not determined.

[d] Determination not yet completed.



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(131-293° F.). And, similarly, 18 hydrocarbons constitute about two-thirds of the fraction 55-145° C. These numbers 8 and 18 are to be compared with the number 100, which represents approximately the total number of known paraffin, naphthene, and aromatic hydrocarbons normally boiling between 55 and 145° C.; and with the number 1,000, which gives the order of magnitude of the total number of *possible* hydrocarbons of these three classes that would be expected to boil between 55 and 145° C. at atmospheric pressure.

The values shown in Table 3 are plotted in Figure 3 as curve A. On the scale of ordinates is plotted the summation of the relative amounts of *n* hydrocarbons in the fraction 55-145° C., and on the scale of abscissae is plotted *n*, the number of hydrocarbons in the fraction 55-145° C. taken in decreasing order of abundance. Following the discussion given above, the 100 per cent line on this chart is located at such a place that the total summation of the 31 hydrocarbons is 75 per cent. The curve A then represents the relation between number of hydrocarbons taken in decreasing order of abundance and the amount of the fraction 55-145° C., which is estimated to be constituted by the given number of hydrocarbons, all within the limits of accuracy of the above data and assumptions. For example, curve A indicates that, of the fraction 55-145° C., three-fourths of the oil is constituted by approximately 31 hydrocarbons, two-thirds by about 18 hydrocarbons, one-half by about 8, one-third by 4, and one-fifth by 2. That is to say, while there may actually be thousands of hydrocarbons in this fraction (indicated by the curve going to large values along the horizontal axis, for 100 per cent of the material) the major part of the material is constituted by a rather small number of constituents.

Curve B, in Figure 3, illustrates the nature of such a relation for a similar fraction from petroleum from the Mount Pleasant field, in Michigan, which contains very large amounts of the normal paraffin hydrocarbon.[98, 101] Curve C, in Figure 3, would be indicative of a very complex crude containing no one hydrocarbon in large amount. The line D indicates the kind of petroleum fraction which nature might have prepared had there been produced together in equal amounts all the approximately 100 paraffin, naphthene, and aromatic hydrocarbons, normally boiling in the range 55-145° C., which are at present known to man. Similarly, line E represents the petroleum fraction which nature would have prepared had she produced together in equal amounts all of the approximately 1,000 possible (order of magnitude only) paraffin, naphthene, and aromatic hydrocarbons which would be expected to boil normally in the range 55-145° C.

TABLE 3—HYDROCARBONS SEPARATED FROM THE FRACTION OF PETROLEUM NORMALLY BOILING BETWEEN 55 AND 145° C. TAKEN IN DECREASING ORDER OF ABUNDANCE

No.	Formula	Hydrocarbon—	Boiling point at 1 atmosphere (°C.)	Estimated relative amount by volume[a]	Summation of the estimated relative amounts by volume
1	C_7H_{16}	*n*-Heptane	98.4	1.1	1.1
2	C_8H_{18}	*n*-Octane	125.6	1.0	2.1
3	C_6H_{14}	*n*-Hexane	68.7	0.7	2.8
4	C_8H_{18}	2-Methylheptane	117.2	0.5	3.3
5	C_7H_{16}	2-Methylhexane	90.0	0.3_5	3.6_8
6	C_6H_{12}	Cyclohexane	80.8	0.3_5	4.0
7	C_7H_{14}	Methylcyclohexane	100.8	0.3_5	4.3_5
8	C_7H_8	Toluene	110.6	0.3	4.6_8
9	C_5H_{12}	3-Methylpentane	63.3	0.2_5	4.9
10	C_6H_{12}	Methylcyclopentane	71.9	0.2_5	5.1_5
11	C_7H_{16}	3-Methylhexane	91.8	0.2	5.3_5
12	C_9H_{20}	2-Methyloctane	143.3	0.2	5.5_5
13	C_6H_{14}	2-Methylpentane	60.3	0.1_5	5.6_7
14	C_8H_{10}	*m*-Xylene	139.2	0.1_5	5.7_9
15	C_8H_{10}	*o*-Xylene	144.4	0.1_5	5.9_1
16	C_9H_{20}	2,6-Dimethylheptane	135.2	0.1	6.0_1
17	C_9H_{16}	Octanaphthene	119.8	(0.1)	6.2_1
18	C_8H_{16}	1,3-Dimethylcyclohexane	120.3	(0.1)	6.2_1
19	C_8H_{18}	Ethylcyclohexane	131.8	0.1	6.3_1
20	C_9H_{18}	Nonanaphthene (alkyl cyclopentane)	136.7	0.1	6.4_1
21	C_6H_6	Benzene	80.1	0.08	6.4_9
22	C_9H_{18}	Nonanaphthene	141.2	0.8	6.5_7
23	C_6H_{14}	2,3-Dimethylbutane	58.0	0.06	6.6_3
24	C_9H_{20}	4-Methyloctane	142.4	0.06	6.6_9
25	C_9H_{20}	3-Methyloctane	144.2	0.06	6.7_5
26	C_9H_{20}	*Iso*nonane	140.8	0.05	6.8
27	C_7H_{14}	1,1-Dimethylcyclopentane	87.5	0.05	6.8_5
28	C_7H_{16}	2,2-Dimethylpentane	78.9	0.04	6.8_9
29	C_9H_{16}	Octanaphthene (1,2-dimethylcyclohexane?)	123.4	0.04	6.9_3
30	C_8H_{10}	*p*-Xylene	138.4	0.04	6.9_7
31	C_8H_{10}	Ethylbenzene	136.2	0.03	7.0

[a]See text on page 210 for explanation. Amounts are based on normal octane unity.

4. Conclusions Concerning the Constitution of the Naphtha Fraction

In connection with the work which has so far been done on that part of this Mid-Continent petroleum normally boiling below 180° C. (356° F.) the following summary may be made:[§§]

(a) On the basis of the present volume of the unresolved material, it is estimated that there has been assigned to individual hydrocarbons over three-fourths of the petroleum normally boiling in

[§§]All estimates of quantity are based on the assumptions discussed on page 210.

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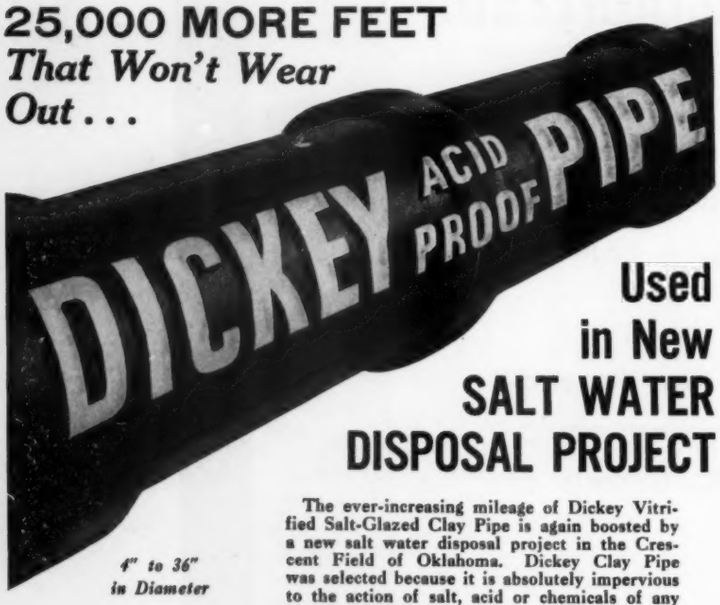

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the range 55-145° C. (131-293° F.) and over one-third of the material normally boiling in the range 145-180° C. (293-356° F.).

(b) All the petroleum normally boiling below 180° C. (356° F.) is composed of paraffin, naphthene, and aromatic hydrocarbons. In the fraction 55-180° C. (131-356° F.), the respective amounts of these three classes of hydrocarbons are approximately 60, 30, and 10 per cent.

(c) The difficulty of separating the various hydrocarbons is least for the normal paraffins, somewhat greater for the aromatics, and greatest for the branched-chain paraffins and the naphthenes.

(d) From the material normally boiling below 180° C., there have been separated 45 different hydrocarbons (24 paraffins, 11 naphthenes or cycloparaffins, and 10 aromatics).

(e) It is estimated that approximately one-half of the entire material normally boiling between 55 and 180° C. (131-356° F.) is constituted by about 12 hydrocarbons.

(f) Of the paraffin hydrocarbons, there have so far been obtained four of the five possible isomers of hexane, four of the nine heptanes, two of the 18 octanes, six of the 35 nonanes, and one of the 75 decanes.

(g) All of the possible aromatic hydrocarbons boiling below 153° C., viz., benzene, toluene, ethylbenzene, *p*-xylene, *m*-xylene, *o*-xylene, and *iso*-propylbenzene, have been found. Each of the three trimethylbenzenes, mesitylene (164.6° C.) pseudocumene (169.2° C.), and hemimellitene (176.1° C.) have also been isolated. In addition, preliminary work indicates the presence of *n*-propylbenzene and each of the three methylethylbenzenes, which normally boil between about 154 and 164° C.

(h) It is estimated that the normal paraffin hydrocarbons from hexane to decane, inclusive, together constitute about one-third of all this petroleum normally boiling between 55 and 180° C. (131-356° F.).

(i) After the normal paraffins, the next more abundant hydrocarbons of the fraction 55-180° C. (131-356° F.) include: 2-methylheptane, cyclohexane, methylcyclohexane, toluene, 2-methylhexane, pseudocumene, methylcyclopentane, 3-methylhexane, 3-methylpentane, and 2-methyloctane, the least abundant of which is estimated to constitute over 1 per cent of the fraction 55-180° C. (131-356° F.).

(j) With the exception of those molecules having five or fewer carbon atoms per molecule, and seven others indicated in Table 2, all the hydrocarbons listed in Table 2 were obtained with a purity of 95 mole per cent or better. Three of the others were obtained with purities of 80, 85 and 91 mole per cent, respectively.

(k) Of the hydrocarbons listed in Table 2, 25 have not previously been actually isolated from any petroleum — the evidence for their presence, where reported, having been in most instances based upon the products obtained by chemical treatment of certain petroleum fractions or upon volume peaks in the distillation curve.

Summary of the Results Obtained on the Lubrication Fraction

In reviewing the results of the work of the project on the lubricant fraction of petroleum, it is well to note that, as regards individual compounds, the chemical constitution of various fractions of petroleum appears to increase in complexity almost geometrically with increase in molecular weight or size of molecules in the given fractions. For example, the hydrocarbons in the lubricating-oil fraction of petroleum contain, on the average, about four or five times as many atoms per molecule as those in the gasoline fraction; and the number of possible isomers of triacontane, $C_{30}H_{62}$, is over 4,000,000,000; while for octane, C_8H_{18}, the number is only 18.

As indicated (page 209), the lubricant fraction of this Mid-Continent petroleum was separated into three broad fractions of nearly equal portions: "extract," "wax," and "water-white" oil. The "water-white" oil was subjected first to a systematic distillation and then to a systematic extraction, resulting in about 600 fractions (15 to 20 grams each) "homogeneous" with respect to type and size of molecules. Each of these fractions constitutes about 1/4,000 part of the original lubricant fraction and about 1/40,000 part of the original crude petroleum and, while not pure compounds, are probably nearer to pure hydrocarbons than any material hitherto obtained from any lubricating oil.

In view of the fact that these fractions are "homogeneous" mixtures containing molecules of the same type and size, the procedure discussed on page 200 concerning the identification of extremely narrow cuts according to type of molecule was followed. Measurements were made of eight important physicochemical properties, and these were correlated with those of pure hydrocarbons of known structure.[49]

As a result of these correlations, the following conclusions have been made concerning the chemical constitution of the 600 fractions of "water-white" oil obtained from the original lubricant fraction by successively extracting the material soluble in sulfur dioxide at about 40° C. (104° F.), removing the "wax" by crystallization from ethylene chloride at —18° C. (0° F.), obtaining a "water-white" oil by filtration through silica gel, distilling systematically in high vacuum, and separating by reflux extraction with acetone:[49]

1. Of the fractions of lowest molecular weight, with about 28 carbon atoms per molecule, the least soluble (in acetone) fractions consist substantially of one-ring naphthene (cycloparaffin) hydrocarbons, and the more soluble fractions consist of

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naphthenes with two, and some with three, rings per molecule, each with the appropriate number of paraffin side chains.

2. Of the fractions of highest molecular weight, with about 37 carbon atoms per molecule, the least soluble consist substantially of two-ring naphthenes (cycloparaffins); and the more soluble fractions consist of naphthenes with three, and some with four, rings per molecule, each with the appropriate number of paraffin side chains.

3. Because of some incompleteness in the separation, the most soluble fractions appear to contain some unsaturated hydrocarbons and an appreciable amount of one-ring aromatic hydrocarbons.

4. No evidence exists to indicate the presence of *iso*- or branched-chain paraffins in this "water-white" oil.

5. It is expected that most of the aromatic hydrocarbons will separate in the sulfur-dioxide "extract" along with the multi-ring naphthenes.

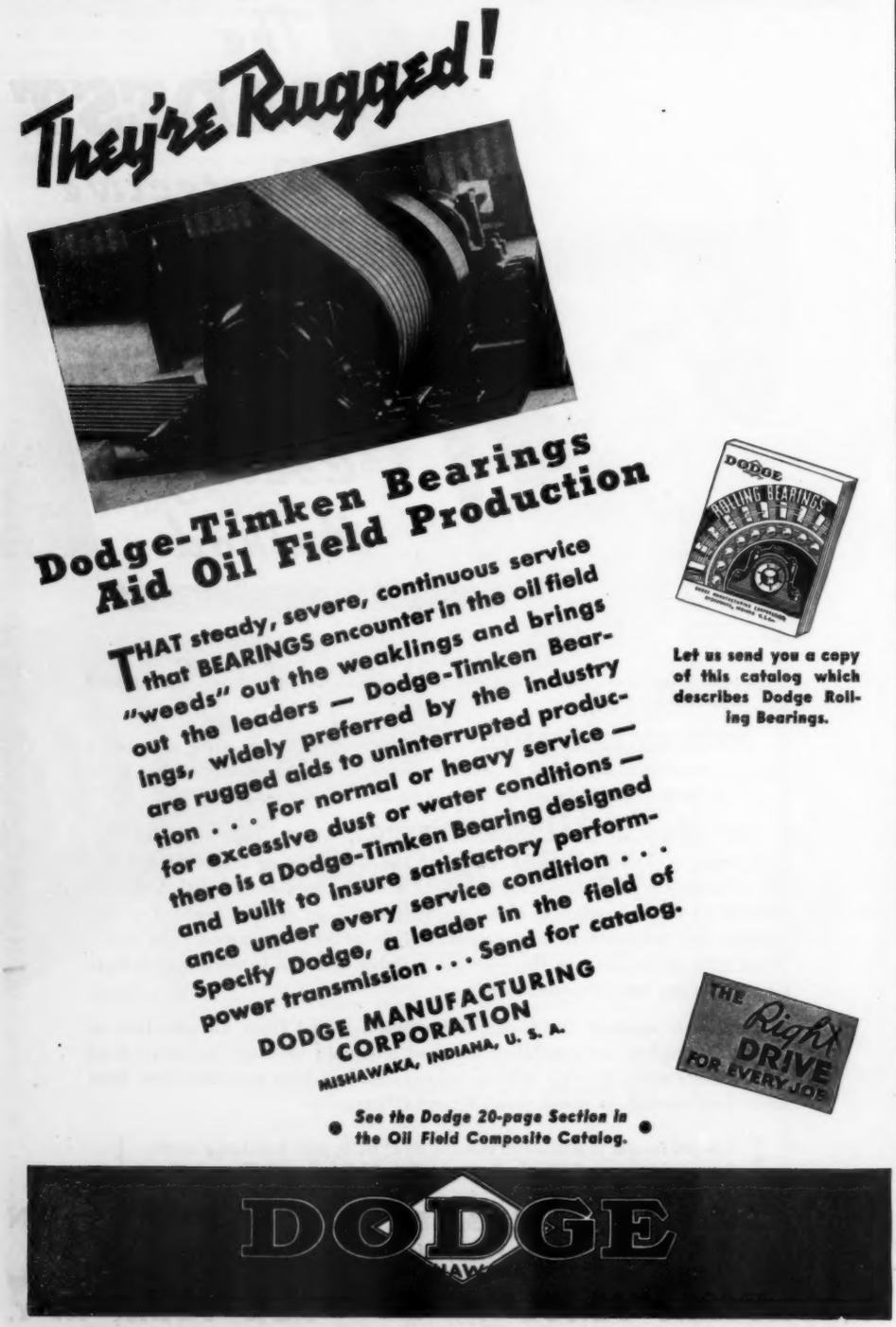
Work in Progress

On its current schedule, the project has the following problems:

1. *The investigation of the chemical constitution of the "extract" portion of the lubricant fraction of this Mid-Continent petroleum.* This work is being done in a manner similar to that employed on the "water-white" oil portion of this same lubricant fraction, and involves the exhaustive resolution of the material into fractions "homogeneous" with respect to type and size of molecule, the measurement of the important physical properties, and the correlation of these properties with those of pure hydrocarbons of known structure in order to deduce the nature of the hydrocarbons in this material. The work so far accomplished[72] on this problem includes the separation of the original "extract" into two portions by dissolving the "extract" in liquid sulfur dioxide and successively extracting, by batch operation, the material soluble in petroleum ether at —50° C. (—58° F.). This material soluble in petroleum ether at —50° C. has been subjected to a systematic distillation in high vacuum through eight stages and, subsequently, separated by reflux extraction with methyl cyanide (plus some acetone for the less soluble fractions) in columns 55 feet long. This material had, before the distillation in high vacuum, a nitrogen content of about 0.13 per cent and a sulfur content of about 0.9 per cent; and the data obtained will show how the distribution of the nitrogen and of the sulfur, respectively, among the various fractions will be affected, first by the systematic distillation in high vacuum and, second, by the systematic extraction.[73] In this work there have been obtained about 175 final fractions (of from 15 to 20 grams), each of which represents about 1/4,000 part of the original lubricant fraction and about 1/40,000 part of the original crude petroleum. Of these 175 fractions, 30 have been designated "key" fractions; and on these, where possible, are being determined the following properties:[73] Molecular weight, carbon and hydrogen content, nitrogen content, sulfur content, viscosity at 100 and 210° F., density, refractive index, refractive dispersion, optical activity, boiling point at 1 mm. mercury pressure, and aniline point. When all these data have been obtained, the correlation with the properties of pure hydrocarbons of known structure will be made in order to determine the exact nature of these compounds, which are expected to be highly aromatic and multi-ring naphthene hydrocarbons.

2. *The isolation and identification of pure aromatic hydrocarbons (suspected to be n-propylbenzene, 1,2-methylethylbenzene, 1,3-methylethylbenzene and 1,4-methylethylbenzene) from the mixture of aromatic hydrocarbons occurring in that part of the gasoline fraction normally boiling between about 152 and 162° C.* This aromatic concentrate has a volume of about 4 liters, and was separated from the approximately 20 liters of the normal mixture of paraffin, naphthene, and aromatic hydrocarbons occurring in this boiling range, by distillation with acetic acid and treatment with silica gel.[62] The fractionation processes expected to be used to resolve this mixture into its constituents include distillation, crystallization and, if necessary, carefully-controlled sulfonation followed by preferential hydrolysis to recover the hydrocarbons, a procedure which was successfully used to separate ethylbenzene and the xylenes.[26, 27]

3. *The exhaustive fractionation of a large quantity (240 gallons) of the dewaxed lubricant fraction of a Mid-Continent crude, with the aim of separating pure hydrocarbons of high molecular weight.* This work was begun by one unit of the project nearly a year ago.[100] Through the courtesy of the Continental Oil Co., there was obtain 6 bbls. of untreated, distilled, dewaxed (with benzol plus ethylene chloride as solvent) lubricant fraction of a Mid-Continent petroleum from the Oklahoma City field, 3 bbls. of "raw 450 distillate," and 3 bbls. of "raw 150 distillate," having viscosities at 100° F. of about 450 and 150 Saybolt seconds, respectively. These two cuts of oil were mixed together, one to one (approximately the production ratio) in order to obtain a mixture having a composition, with the exception of the removed wax, substantially the same as that of the corresponding fraction in the natural crude. The Sun Oil Co. kindly ran 240 gallons of this oil in a semi-plant column at Marcus Hook, Pa. Ten passes of the oil were made through their still under vacuum (5 to 8 mm. mercury), and 11 fractions were obtained—nine 10 per cent distillation cuts, a residue, and "hold-up." About 80 gallons of this oil has been left unfractionated, subject to future reference. Of the nine distillation fractions of this oil as obtained from the semicommercial still, the properties of the lightest and heaviest fractions, respectively, were as follows: Viscosity at 100° F., 0.173 and 1.58 stokes (86 to 730 Saybolt seconds); density at 100° F., 0.875 and 0.893 g. per cc.; refractive index, n_D^{25}, 1.492 and 1.502; boiling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point at 1 mm. mercury, 159 and 238° C. (318 and 460° F.); viscosity index, 78 and 60. In the laboratory of the project at the National Bureau of Standards, there was built a high-vacuum, metal distillation column, 6 inches in diameter and about 7 feet long, for carrying out a rectification of this oil in high vacuum (pressure less than 0.001 mm. mercury at the outlet of the condenser). The 240 gallons of oil has received one systematic distillation through this column, and the second stage is well under way. When the oil has been separated into substantially constant-boiling fractions, it is planned next to subject the material to a systematic process of extraction.[180]

Future Work

In connection with the future work of the project, some important fractions of petroleum await investigation, and included in this work are the following problems:

1. *The separation of the mixture of branched-chain paraffins and naphthene hydrocarbons occurring in the normal boiling range 145-160° C.* From that part of the original material normally boiling in this range, there have already been separated the pure hydrocarbons, normal nonane[15] and *iso*-propylbenzene,[81] and the aromatic concentrate now under investigation, leaving as material remaining for future work the mixture of branched-chain paraffins and naphthene hydrocarbons. This is about the lowest-boiling range in which there is a possibility of finding naphthenes with a "strutted" structure.

2. *The separation of the material (a mixture of naphthenes and branched-chain paraffins, and some aromatic concentrate) remaining in the range 160-180° C.* From that part of the original petroleum normally boiling in this range, there have been separated the pure hydrocarbons, normal decane[18] and each of the three trimethylbenzenes,[72] leaving the above mixture of *iso*paraffins and naphthenes, and some aromatic concentrate, for future investigation. Some of the hydrocarbons normally boiling near this range, and which may possibly be found in the oil, include the butyl-, methyl-, propyl-, diethyl-, and dimethylethylbenzenes, mono- and bicyclic naphthenes of 10 carbon atoms, and branched-chain decanes.

3. *The further resolution of certain relatively small "recalcitrant" fractions, containing isoparaffins and naphthenes, still remaining in the range below 145° C.* While all the petroleum normally boiling below 145° C. is considered substantially worked out, there remain certain concentrates containing *iso*paraffins or naphthenes, or both, which may respond to the more newly-developed methods of separation, and should be subject to future

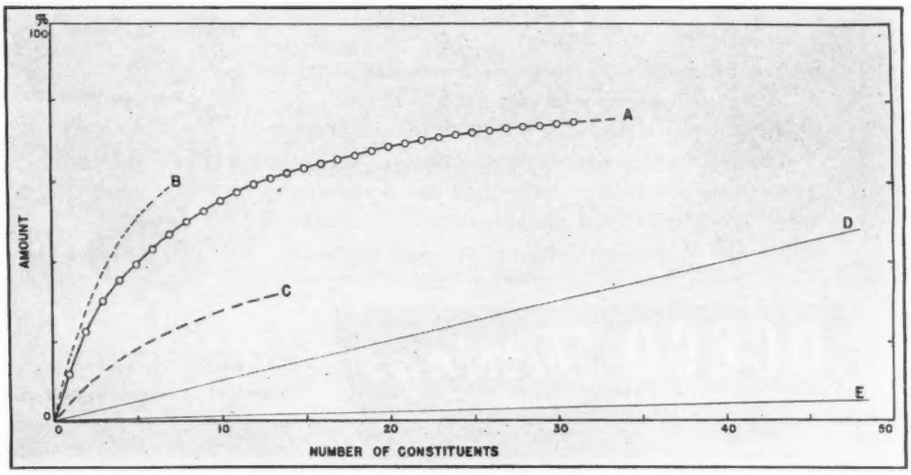


Fig. 3—Plot showing the relation between the number of constituents, and their estimated amounts, in that fraction of petroleum normally boiling between 55 and 145° C. (131 and 293° F.)

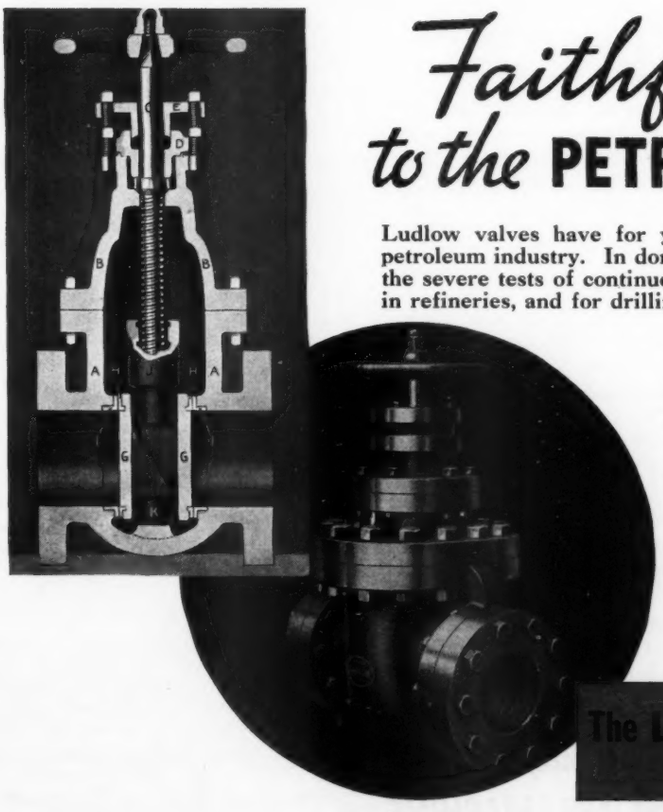
The scale of ordinates gives the estimated amount of the fraction 55-145° C. which is constituted by a given number of constituents; and the scale of abscissae gives the number of constituents taken in order of abundance.

Curve *A* represents the estimated amounts of the fraction 55-145° C. which is constituted by the various numbers of hydrocarbons, from 1 to 31, actually separated from this fraction of Mid-Continent petroleum, which hydrocarbons are taken in order of abundance. The estimates of amount are based on the values given in Table 3 and on certain assumptions discussed in the text on page 210.

Curve *B* indicates the relation which would obtain for the 55-145° C. fraction of a petroleum containing very large amounts of the normal paraffin hydrocarbons (see text page 212).

Curve *C* indicates the relation which would obtain for the 55-145° C. fraction of a "complex" petroleum containing no one hydrocarbon in large amount.

Curves *D* and *E* indicate the relations which would obtain for mixtures of equal amounts of 100 and 1,000 hydrocarbons, respectively (see text page 212).



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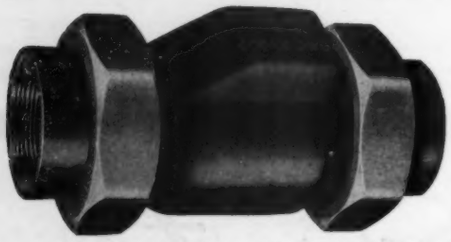

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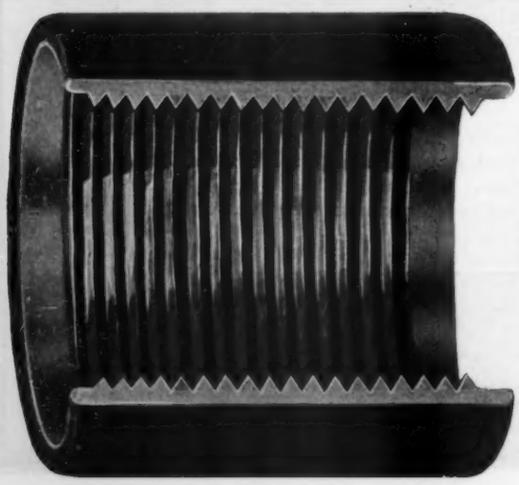

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work. These include fractions at 91-92° C., 110-112° C., 126-128° C., 132° C., and 138° C.

4. *The investigation of the hydrocarbons in the kerosene fraction of petroleum.* So far in the work of the project, no material containing hydrocarbons with from 11 to about 25 carbon atoms per molecule has been subjected to investigation, and the kerosene fraction appears to be promising material for the opening wedge into this little-explored region of petroleum hydrocarbons. In this material, as contrasted with the gasoline fraction, there is the possibility not only of many more isomers but also of combination structures involving paraffin, naphthene, and aromatic groups.

One of the most important phases of the future work of the project in its primary business of separating petroleum into its constituents (as indicated by the specific problems listed) will be the improvement, to a higher degree of efficiency, of the existing laboratory methods of fractionation, and the development of new ones, in order to cope effectively with the more difficultly separable fractions which are in the offing.

At the present time the processes of fractionation commonly used in industry and various research and development laboratories are those of distillation, crystallization, extraction, adsorption, and certain variations and combinations of them. These processes are based upon the following properties as "vulnerable" to the given fractionation: Boiling point, freezing point, solubility in various solvents, susceptibility to adsorption on appropriate solids, and ability to form azeotropic mixtures. In addition to the foregoing processes of fractionation there are two others less widely use: Molecular distillation,[1, 45, 100] at very low pressures, in which the fractionation depends primarily upon the respective ratios of the vapor pressure to the square root of the molecular weight of the constituents; and centrifuging at extremely high speeds,[108, 100] in which the fractionation depends primarily upon the density of the various constituents. The latter two methods have so far been used mainly in the fractionation of biologically-important substances, but there is no reason why these processes cannot be extended to mineral oils, provided sufficiently worthwhile constituents can be separated by their use. In developing a new process of fractionation which may be even more effective for certain problems than the existing processes, there must first be selected an appropriate physical property which has significantly different values for the various constituents to be separated, and then there must be devised a workable apparatus to whose operation the given property is a "vulnerable" one.

Another important phase of the future work of the project lies in the field relating to the determination of the physicochemical properties of pure hydrocarbons, for record and identification; and of mixtures of hydrocarbons, for characterization and for indicating the extent of fractionation resulting from a given process of separation. Efforts in this direction will involve the adaptation to these uses of old methods of measurement and of newly developed methods which appear applicable to this work.

Conclusion

Although investigations on the nature of petroleum have been going on for many decades, it was not until about 20 years ago that the petroleum industry itself began to consider seriously the chemical constitution of its raw material. With a few notable exceptions, the researches on the chemical constitution of petroleum had been sporadic and casual; and, relative to the importance, magnitude, and complexity of the problem, greatly limited in scope. A dozen years ago there were a number of hydrocarbons whose presence in the gasoline fraction of petroleum was reported, but for molecules of more than five carbon atoms the evidence was in most cases based upon the products obtained by chemical treatment of certain petroleum fractions or upon volume peaks in the distillation curve. What was needed was a comprehensive and uni-

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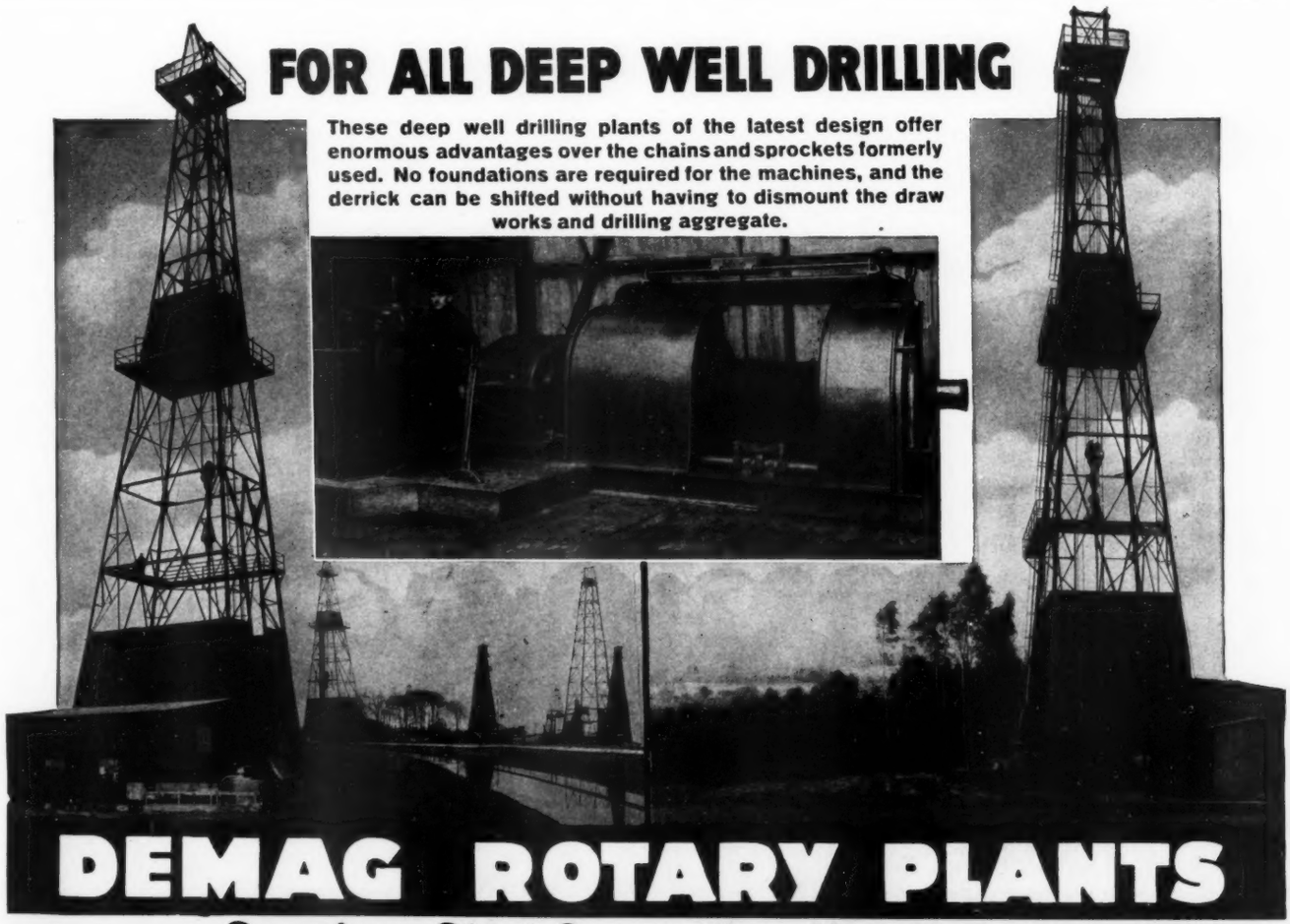

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fied investigation of the chemical constituents based upon the actual isolation of pure hydrocarbons from the crude oil. In reviewing the cooperative research on the chemical constitution of petroleum which has been carried on since 1927 by the American Petroleum Institute and the National Bureau of Standards, it appears that considerable farsightedness was manifested by the sponsors in initiating such a project at that time. No other single move could have been better calculated to impart such a healthy impulse to the growth of various other researches in or important to the petroleum industry.

For some years there has been under way in the industry a transition from the production of a few exceedingly broad fractions of petroleum, having general properties, to the manufacture of many different narrow cuts having specialized properties. The general properties of each of the broad fractions have been such as to satisfy fairly well the requirements of a number of different services; but the need for greater efficiency, higher speeds, and more concentrated power, the use of high pressures and high and low temperatures, and the invention and development of devices for improving the comfort and welfare of man, inevitably leads to the necessity of manufacturing materials of specialized properties which can better fill the ever-expanding and more exacting requirements of today.

The wresting from nature of knowledge of the chemical constitution of petroleum, with the attendant development and improvement of methods of fractionation and measurement of properties, serves the petroleum industry in two ways. First, there are provided data and information which can be utilized by the industry to improve the control and economy of the processes used for producing the broad fractions (gases, gasoline, fuel oil, and lubricants) which are the bulwark of the industry at the present time. Second, there is provided a knowledge of the available hydrocarbons in petroleum, and of methods for effecting their separation, which is a necessary requirement in the manufacture of fractions having specialized properties, and in the development of a petroleum chemical industry, which must deal with substantially pure hydrocarbons or with highly-fractionated "homogeneous" material.

The petroleum chemical industry, whose "coming of age" may be said to have been celebrated by the symposium on the "Chemical Utilization of Petroleum Hydrocarbons" held by the Division of Petroleum Chemistry of the American Chemical Society, at Rochester, N. Y., in September of this year, is a development following naturally from the combined effects of a number of causes. The first of these may be taken as the work of determining the identity and approximate amount of the significant hydrocarbons actually in petroleum; the second is the development of processes of fractionation which can be used economically on a commercial scale to effect the separation of wanted hydrocarbons; and the third is the accumulation of information on the chemical thermodynamic and kinetic constants of hydrocarbons and their derivatives. As far as the development of the petroleum chemical industry is concerned, any one of the factors just mentioned would be of no avail in the absence of the other two.

At the current prices listed by chemical supply houses for the best hydrocarbons (boiling ranges 0.5 to 2° C.) regularly purchasable for laboratory use, 20 gallons of a Mid-Continent "straightrun" gasoline, having a wholesale value of about $1, has a potential value of about $1,000 in terms of the amounts of the five normal paraffin hydrocarbons, *n*-hexane to *n*-decane, inclusive, which can be separated from it. When the existing laboratory methods for separating hydrocarbons from petroleum are successfully worked out on a commercial scale, the cost of producing these hydrocarbons will be considerably less than those of other processes, synthetic or otherwise. The petroleum chemical industry is now successfully utilizing methane, ethane, propane, *n*-butane, *iso*butane, *n*-pentane, *iso*pentane, ethylene, propylene, *n*-butene, and *iso*-butene, to produce alcohols, glycols, ethers, oxides, aldehydes, ketones, esters, acids, anhydrides, chlorinated compounds, amines, resins, "*iso*octane" motor fuel, etc., by the various processes of polymerization, depolymerization, hydrogenation, dehydrogenation, oxidation, halogenation, hydration, dehydration, and "alkylation".[103] It is apparent that the range of products can be enormously increased once the use of hydrocarbons of higher molecular weight (six and more carbon atoms) as starting material is made commercially possible by their separation from petroleum. Judging from the recent reports of several groups of investigators,[101, 104] it appears that the separation of a number of important hydrocarbons of more than five carbon atoms per molecule from the gasoline fraction, on a semi-commercial scale and in a state of relatively high purity, is now an accomplished fact.

The researches necessary to carry on a petroleum chemical industry, whose purpose is substantially that of achieving a more economic utilization of petroleum, may logically be divided into two groups: (1) Fundamental researches and (2) applied researches. The fundamental researches include (*a*) the investigation of the chemical constitution of petroleum, and (*b*) the determination of the chemical thermodynamic and kinetic constants of hydrocarbons and their derivatives; and the applied researches include (*a*) the development of practical commercial methods for effecting the separation of wanted hydrocarbons and (*b*) the investigation of various chemical reactions involving petroleum hydrocarbons and their derivatives for the purpose of obtaining new and desirable substances for the manifold needs of man. The fundamental researches ought properly to be carried on

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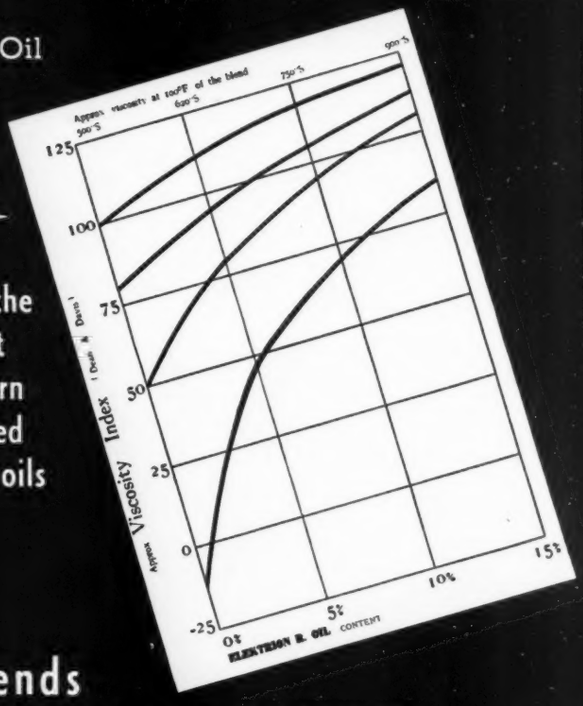

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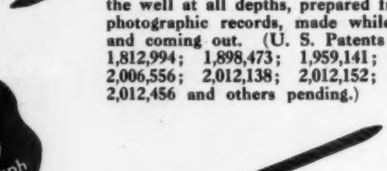

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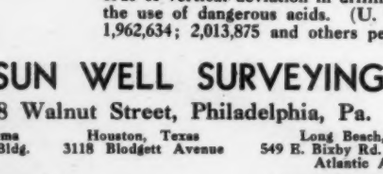

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and encouraged in the university and government laboratories, leaving the competitive research and development units of the industry to make practical application of the knowledge and data obtained by the nonprofit laboratories. The system should be a self-perpetuating one within the industry, profiting from its applications of the basic knowledge and data, would be anxious to assure the continued flow into the proper channels of resources for researches on base-line problems.

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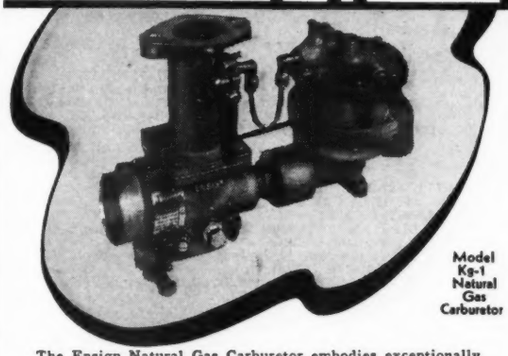

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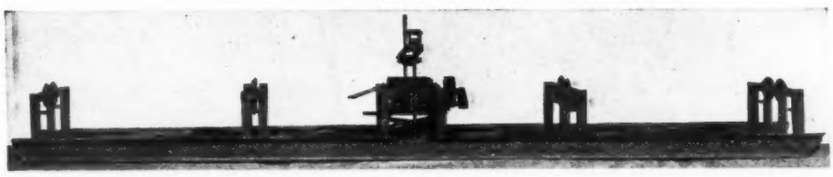

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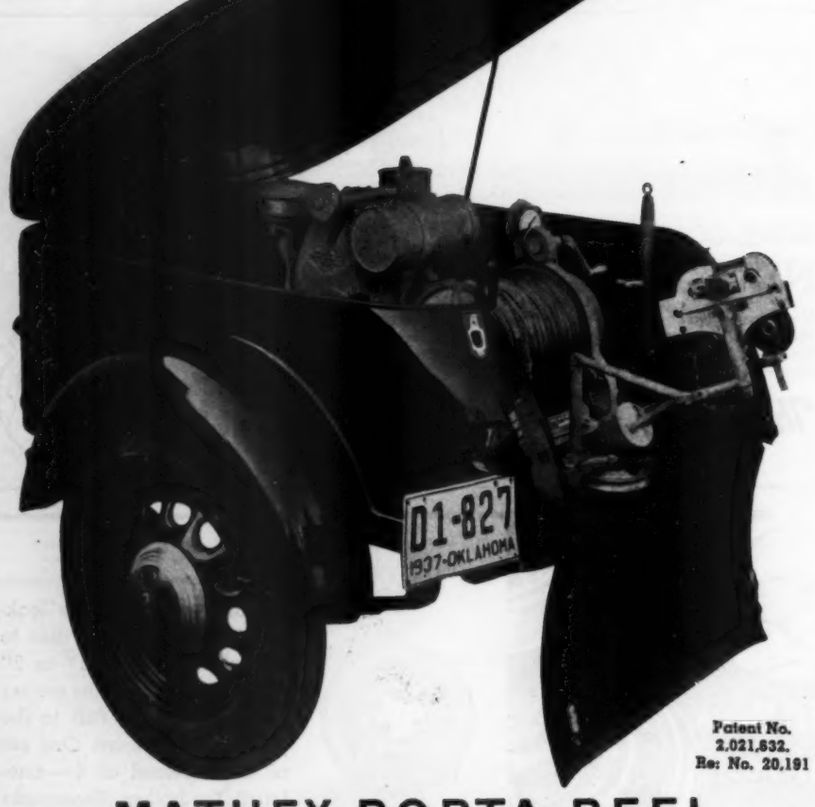
Well Surveying Made Easy



Patent No. 2,021,832. Re: No. 20,191

MATHEY PORTA-REEL

—For measuring depth of well
—To locate an obstruction
—To locate fluid level
—To run bottom hole pressure and temperature bomb

The Mathey Porta-Reel is designed and built to give maximum performance and safety in well surveying. Reel capacity is 12,000 feet of standard measuring line. This unit is available in two types: for installation in small panel truck or car with power take-off from transmission; as a self contained gasoline powered unit assembled in a sturdy wooden box or for mounting in trailer as shown above. Measure meter is available for both types. This meter will operate on all sizes of line, solid, insulated, or stranded.

C. A. MATHEY MACHINE WORKS

305 East 3rd St. Tulsa, Oklahoma

Gasoline Tax Increases Retard Automobile Use

Curtailed use of automobiles and loss of retail trade resulted in four states which increased gasoline tax rates this year, according to a study made by the American Petroleum Industries Committee. Consumption of gasoline lagged in the four states following higher rates, an increase of 1 cent per gallon. In one state, Minnesota, consumption was not only retarded, but fell below 1936, whereas gasoline consumption for the country as a whole shows a gain of better than 10 per cent this year.

In West Virginia a tax increase went into effect April 1. Prior to the increase, consumption showed a gain of 30.2 per cent over the first quarter of 1936. During the next four months—April through July—the rate of increased consumption receded to 5.2 per cent. In the five states bordering West Virginia, consumption gain during the four months was 10.2 per cent, or double that of West Virginia.

In Rhode Island gasoline sales during the first four months were 13.3 per cent above the first third of 1936, or slightly above the average gain in consumption for the country. On April 21 the state increased the gasoline tax rate from 2 cents to 3 cents. During the following three months, the consumption gain slumped off to only 4.4 per cent. The neighboring states of Massachusetts and Connecticut showed a gain of 6.5 per cent for the three months, 50 per cent above that of Rhode Island.

The depressing effect of a 1-cent increase in Minnesota was pronounced. During the first four months consumption in Minnesota was 13.7 per cent above the same third of 1936. On April 23 a 1-cent increase became effective. Consumption for May, June, and July declined to 0.6 per cent below the same three months last year. In the four adjacent states it averaged 6 per cent over 1936.

In New York a 1-cent increase became effective on May 10. During the first four months consumption in New York showed a gain of 12.8 per cent. After the increase, the rate of gain dropped to only 5.4 per cent. Sales in five adjacent states stood at 9.8 per cent.

Measuring and Testing Gas

Announcement has been made of the publication by the American Petroleum Institute's Division of Production of "A.P.I. Code 50-A, Measuring, Sampling, and Testing Natural Gas (Tentative)." Development of the code, begun in 1932, has been under direction of the Division of Production Main Committee on Measuring, Sampling, and Testing Natural Gas and Natural Gasoline, with F. E. Rice, vice president, Phillips Petroleum Co., Bartlesville, Okla., as chairman. Detailed considerations in measuring, sampling, and testing have been carried on by a technical subcommittee, Group 2, under the chairmanship of George P. Bunn, also of the Phillips Petroleum Co.

PROBLEMS FROM READERS

Edited by L. G. E. Bignell

Etching Small Tools

Can you outline some method for etching identification marks on small metal tools? I understand this can be done with acid but am not certain about the kind of acid to be used or the procedure.—S. H. R.

A simple way to do this is to secure some hydrochloric acid from a local drug store. It is not necessary to know the concentration of this acid because the acid available at any drug store will suit, the only difference that might result would be that a strong acid will act more quickly than a weak one. At the same time secure some bars of paraffin wax such as used for sealing cans or jars.

Take a porcelain dish and pour some hydrochloric acid in it and add some water. Put the small tools in this bath and clean of all grease and dirt. The larger tools can be cleaned by applying the acid with a swab or brush. Be certain the spot to be etched is clean so that the bare metal will be exposed to the attack of the acid later.

Melt the paraffin and coat the area around the spot to be etched with a good layer of this hot paraffin. Allow it to cool and build up around the edges of the spot a small ridge or dam. This done take some sharp instrument and scratch through the coating of paraffin the desired initials or design. Be certain the paraffin is scratched through so the metal is exposed and also be careful the paraffin is not broken at any other place than at the desired design. Wherever the paraffin is removed the acid will attack the metal.

Having thus prepared the metal apply the full strength hydrochloric acid as secured from the drug store to the exposed metal and if possible fill the small pool formed by the dam of paraffin with acid. As the acid attacks the metal fumes will be given off and this fuming will continue until the acid is spent. When fuming stops the spent acid should be carefully washed off and a new application of fresh acid made. This will again fume and when it has ceased the tool should again be washed. Repeat this process until the etching in the metal is as deep as desired, then remove the paraffin, wash the whole tool and the job should be done. Hydrochloric acid is suitable for etching small tools and is reasonably safe to handle.

Sand Trouble in Water Wells

We are drilling quite a few water wells and desire to drill them as inexpensively as possible for a permanent and good well. I will appreciate any suggestions you can give me to overcome some of our troubles. It seems to us we bail out too much sand in drilling and we are afraid the wells may sand up within a few months. Can you suggest a better method for completing wells than those shown in the accompanying sketches? The wells are drilled in or near an old river bottom. Can you give me the name and address of some one who has published a book with illustrations on methods of drilling water wells?—C. E. P.

It would seem that the use of the gravel pack would best serve your needs and you must not expect to exclude all fine sand if the volume of water desired is large. In other words, if you have need for a lot of water the velocity of the stream into the well will be high and a high velocity current will carry fine sand. The velocity is relative and we do not refer to open stream flow but in a loose water sand the water velocity is fairly high.

If a fine screen is used the fine sand will pack outside of the screen and this may build up sufficient resistance to impede the flow of water into the well. A properly placed gravel fill between the well casing and the hole should tend to sort out sand to fill pore spaces between the grains of gravel and as the larger spaces are filled finer sand will be accumulated until a good screening effect is attained.

It is suggested you write the United States Geological Survey, Washington, D. C., Water Supply Department, for such literature as may be available about completion of water wells. That department has published some very excellent information about water wells and this should be available and of use to you.

Inasmuch as the primary object of water wells is to produce as much water as possible you cannot afford to seal off the sand too tightly.

If the space around the bottom of the casing is open to permit entrance of water then fine sand will enter the well. This sand can be made to settle if velocity of the current is reduced. If the velocity is reduced in the casing the sand will not be carried to the surface. But it is better to carry the sand out of the well and it can then be very easily dropped by decreasing velocity of flow.

To reduce this velocity the stream of water can be flowed into an inverted cone shaped tank. The water enters such a tank through a central flume and is carried down. The water flows out of the cone into a launder placed around the edge and as this velocity of escaping water is relatively low the sand will tend to settle to the bottom of the cone and can be drawn off intermittently or continuously.

It therefore follows that a good gravel packed well will give the maximum volume of water with some sand but the sand can be easily dropped out of the stream at the surface.

It is possible to wash the liner into place. The holes in the liner are closed with neat cement. The bottom of the liner is fitted with a pointed shoe with a short left hand threaded nipple sticking up in the inside of it. Into this nipple tubing is screwed. Through the tubing water is pumped or jetted against the sand and the liner attached to or free of the casing above it is forced downward into the sand body. When hard pan is reached the rate at which the liner sinks will be noted and the pumps stopped. The tubing can then be unscrewed and removed. The inner shell of cement can be scraped off the liner leaving the holes open. Before this is done the gravel should be packed between the outside of the liner and the hole and the balance of the hole cemented.

Wants Information About Venezuela

I have chosen for my master's degree the topic "Economic Aspect of Oil in Venezuela." Any material you can send me, or tell me where I can find it will be greatly appreciated.—W. M.

Complying with your request for information about Venezuela, we enclose a bibliography of articles on that country prepared for us by the Technical Department of the Tulsa Public Library.

Why Does Well Produce by Heads?

We have a well in the Noble field, Illinois, producing from the McClosky lime through 2½-inch tubing which will build up pressures high enough to eject the oil from the hole. Bottom-hole pressure gauge records indicate 1,100 pounds maximum pressure and after the well has made a head of oil and gas the pressure drops to about 600 pounds. The lime has been acidized. What might cause this irregular manner of producing? The well is on the pump.—L. L. S.

It is rather difficult to make any definite suggestions from the information at hand but it would seem that the well is being pumped down too rapidly and when the column of oil in the hole is lowered the gas pressure will cause the balance of the oil to be blown out in a head flow. The drop from 1,100 to about 600 pounds at the bottom of the hole indicates too rapid production.

To remedy this trouble you might try raising the tubing in the well. With 1,100 pounds formation pressure it is possible to sustain a 1,500-foot column of oil in this hole. If this is the case it might be well to raise the working barrel up, to say 1,000 feet from bottom, allowing a 500-foot column of oil to remain above the working barrel and then to slow down pumping speed and length of stroke so that this 500-foot head is not lowered too quickly.

By operating this well with the casing head shut in and the back pressure on the formation occasioned by the column of oil it is probable the oil will enter the hole at a more steady rate and gas will be conserved to produce more oil. If the well is permitted to continue to blow out frequently there will be a loss of formation energy which will effect ultimate production.

Possibilities of Oil in Hansford County, Texas

I have some property in Hansford County, Texas, which I want to check up on regarding oil possibilities. Do you have any maps showing oil structures or could you advise me where I could get some covering that part of the state?—R. S.

I am afraid that there is not much detailed information published on that particular area because it is as yet unexplored with the drill.

There was a showing of gas in a well in the northwest corner of the county, however this is a large county and you do not state where your property is located.

If you are seriously interested in securing information you should engage the services of a reliable geologist to make a report upon the area within which your property is located.

Another way to get a check upon the gas and oil possibilities in the neighborhood of your property is to await leasing developments. If someone seeks to lease your land for drilling purposes you may be certain that some geological information has been developed that is encouraging, but whether the drill will find gas or oil will have to await future developments. Until the area is condemned by the drilling of dry holes there is always gas and oil possibilities for it is in a region which may contain undiscovered gas and oil fields.

QUESTIONS ON TECHNOLOGY

By Charles K. Francis, Ph.D., Technical Editor

Formation of Color in Gasoline Upon Exposure to Sunlight

Is it known what causes the formation of primary colors, such as red and green, in gasolines, when exposed to the sun?—W. E. M.

Aromatics, sulfur compounds and the nitrogen, present in most crude oils, are substances that form colors. Traces of these may persist in gasoline. Many color bases produce one color in the presence of an alkali and another if there is some acid present. A gasoline may be without color but when exposed to the sunlight enough decomposition, or oxidation, takes place to form small quantities of acid, or acid substances, sufficient to produce the color.

The phenols and mercaptans are thought to be the source of some color in the light oils. It is only the exceptional gasoline that will show any color other than a yellow to brown. The mercaptans, phenols, etc., boil at a temperature too high to be included in any appreciable quantity in the gasoline fraction. The same is true as to sulfur and nitrogen. The oils containing thiopenes may yield a gasoline with an exceptionally high sulfur content and such compounds are known to be capable of forming color compounds such as brown, reds and greens, which have been observed in the chemically treated fractions of the gasoline range.

Several years ago Elgin reported an interesting set of experiments with mercaptans and a nickel catalyst. "On shaking the naphtha solutions of butyl and isobutyl mercaptans with the reduced nickel catalyst a deep red color developed after about a 10-minute interval. This color completely disappeared after 10 days' standing."

The red color is more often met with than any other, usually appearing in the lubricating oils.

Reference: Elgin, Ind. Eng. Chem., 22, 1292, 1930.

Aniline Equivalent Formerly Represented Antiknock Rating

With reference to the knock standard of gasoline, what is the meaning and derivation of aniline equivalent?—N. E.

Before the introduction of the system for expressing the knock rating of motor fuels in terms of octane numbers, various schemes were proposed. Among these was the aniline unit.

Aniline was known as a strong knock suppressor. Lovell, Campbell and Boyd proposed to evaluate the relative knocking tendencies of motor fuels in terms of aniline equivalent. The reference fuel contained 1 gram-mol of aniline in a liter of gasoline. The scheme is explained by the authors as follows:

"For example, the aniline equivalent of isooctane, (mol. wt. 114), is 16. This means that 114 grams of the isooctane made up to a liter with gasoline (about a 17 per cent solution of the hydrocarbon by volume) is equivalent in knock to a liter solution of aniline (mol. wt. 93) in gasoline containing 16/100 x 93 grams of aniline (about 1.5 per cent solution by volume). Similarly the aniline equivalent of —14 for n-heptane (mol. wt. 100) means that 100 grams of the heptane and 14/100 x 93 grams of aniline made up to a liter with the reference gasoline knock the same as the reference gasoline. This makes the solution contain about 15 per cent heptane and 1.3 per cent aniline by volume.

"The precision of the measurements obtained in this way has been found to be within ±1.0 unit of aniline equivalent for compounds upon which two or more determinations have been made. The octane value of the reference fuel was 55.

"The aniline equivalent of benzene is +10 and that of the standard gasoline containing 3.0 cc. of lead tetraethyl per gallon is also about +10.

"In order to convey some conception of the magnitude of this scale of knock rating, it may be stated that when tested alone or without admixture with gasoline, normal heptane, which has an aniline equivalent of —14, and isooctane, which has an aniline equivalent of +16, begin to knock at compression ratios of 2.75:1 and 6.9:1, respectively, under certain specified conditions in an engine similar to the one used in this work."

Reference: Lovell, Campbell and Boyd, Ind. Eng. Chem., 23, 26, 555, 1931.

Condition of Carbon Black Industry in 1936

Information is divided on the manufacture of carbon black from natural gas. What is the market? Does it have a wide range in price? Does the demand exceed the supply?—E. A. D.

The complete survey of the carbon black industry, as for the year 1936, given by G. R. Hopkins and H. Backus in the Minerals Year Book for 1937, is the authority for the data presented in answering this inquiry.

Prices for carbon black remained uniform throughout the year at slightly under 4 cents a pound, with the export rate at about 1 cent more. The average at the plants was 3.92 cents per pound in 1936 and 3.90 cents in 1935. The highest price received in the past 10 years was 5.52 cents per pound in 1927 and the lowest 2.75 cents in 1932.

There are 54 carbon black plants in the United States, of these 16 are in Louisiana, 2 in Oklahoma, 35 in Texas and 1 in Wyoming, having a total daily capacity of 1,432,095 pounds. The total production for the year was 411,345,000 pounds, obtained from 283,421,000,000 cubic feet of natural gas, equivalent to an average yield of 1.45 pounds per 1,000 cubic feet of gas. Stocks declined from 136,086,000 pounds in 1935 to 79,582,000 pounds on December 31, 1935.

The consumption of carbon black is given in the table.

CONSUMPTION OF CARBON BLACK YEAR 1936

Industry—	Pounds	Per cent
Domestic:		
Rubber	278,018,000	89
Ink	17,787,000	6
Paint	6,914,000	2
Miscellaneous	10,299,000	3
Total domestic	313,018,000	
Export	154,718,000	
Total sold	467,736,000	

There was an increase in production over the previous year of about 60,000,000 pounds, mostly accounted for in the plants of the Texas Panhandle, credited with nearly 80 per cent of the total United States production. The output of channel black increased from 316,284,000 pounds in 1935 to 366,876,000 in 1936; the other processes, the Lewis, roller, "special" and thermatomic increased from 36,465,000 pounds in 1935 to 44,469,000 in 1936.

The production did not equal demand in 1936. Substantial quantities were withdrawn from stocks.

Reference: Hopkins and Backus, Carbon Black, Minerals Year Book 1937, U. S. Dept. Interior, Bureau of Mines, p. 1109.

Analysis Jackson Pool Oil, Eddy County, New Mexico

Will you furnish, if available, analysis of New Mexico crude oil? This oil was mentioned in The Oil and Gas Journal of September 9, 1937.—M. P.

The Jackson area of Eddy County, New Mexico, is in what is known as the Monument field. The largest well, recently reported, had an initial production of 1,027 bbls. at 3,350-3,510 feet after acidizing.

PROPERTIES OF THE CRUDE OIL

Gravity, deg. A.P.I.	35.9
Pourpoint, deg. F.	20
Initial boiling point, deg. F.	95
B.S., per cent	0.1
Sulfur, per cent	0.86

Products by Distillation

	Per cent
Gasoline	42.4
Gravity 53.1	
Kerosene	None
Gas oil	30.9
Gravity 32.1	
Residue	25.5
Gravity 17.8	

Gasoline, deg. A.P.I.	53.1
Initial, deg. F.	130
Max., deg. F.	428
Octane No.	50
Sulfur, per cent	0.12
Residue, deg. A.P.I.	17.8
Flash, deg. F.	500
Pour, deg. F.	90
Viscosity at 122° Furol	177
Sulfur, per cent	1.83
Gas oil, deg. A.P.I.	32.1
Flash, deg. F.	255
Fire, deg. F.	295
Pour, deg. F.	10
Vis. at 100° F., sec.	44
Initial, deg. F.	486
10 per cent	510
50 per cent	576
90 per cent	674

Note—Large quantities of hydrogen sulfide evolved during distillation.

CHEMICALS FOR THE PETROLEUM INDUSTRY

Aluminum Chloride Anhydrous

Use—Syntheses; preparation of lubricating oil and gasoline. Desulfurizing, decolorizing.

Form—Yellow to greenish crystalline mass.

Odor—Hydrochloric acid, pungent.

Formula—$Al Cl_3$

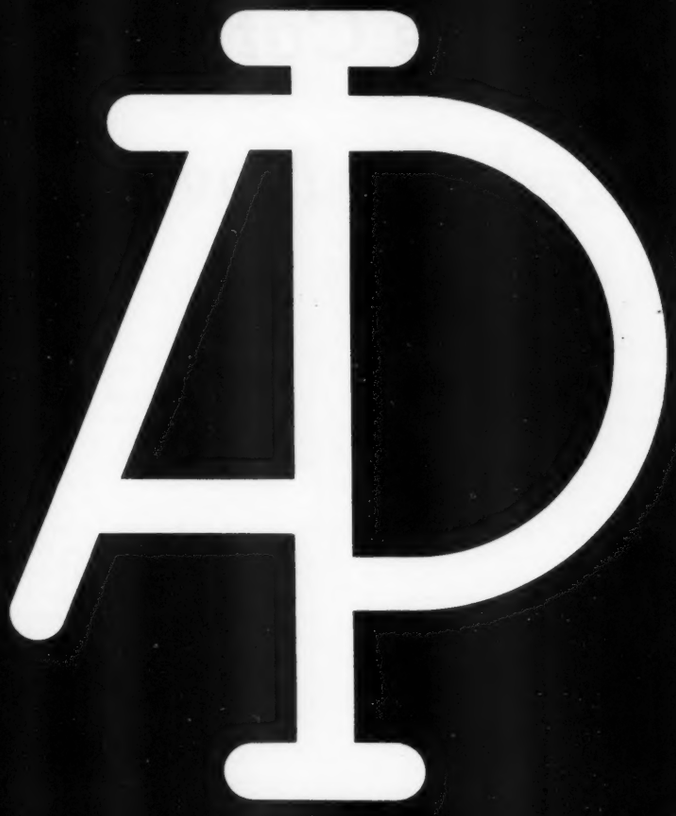
Specific gravity—2.44.

Melting point—356° F.

LIMITATIONS

Total impurities, per cent 0.4

Note. Aluminum chloride may be obtained in several other forms—the granular crystals and powder, also solutions containing 30 to 50 per cent.



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Mid-Continent Refiners Cut Runs by Over 30,000 Barrels for November

By D. H. STORMONT

Mid-Continent refiners during November will reduce their daily runs to stills by slightly over 30,000 bbls., according to estimates made at the first of the month. This month will be the first time that runs will have fallen below the 600,000-bbl. mark since last June, and the first time this fall that a substantial reduction was made in refining schedules. Total runs for the area during November will approximate 588,000 bbls. daily.

Recent cuts in gasoline quotations are causing several refiners to close down their plants this month. Prices of the various grades are now lower than at any time since early in 1935, regular grade being one-quarter cent lower than at this time last year. And, since refiners are now paying 12 cents more per barrel for their crude than in 1936, very little profit, if any, is being derived from gasoline manufacturing.

Of the eight districts comprising the Mid-Continent, all but North Louisiana and the Texas Panhandle show decreases. Oklahoma, with a decline of almost 15,000 bbls., leads by far the other districts in cutting back of daily runs. Runs to stills in nearly all large Oklahoma plants are being reduced this month. Cities Service Oil Co. is cutting runs in its Ponca City plant by 2,000 bbls., Pure Oil Co. at Muskogee by some 900 bbls. and many others by lesser amounts. The Blackwell plant of Globe Oil & Refining Co. is to be closed down after being operated for the past year at near-capacity levels. Wilcox Oil & Gas Co. at the first of the month was undecided as to whether or not its Bristow plant would in operation all of this month.

Kansas Shows Reduction

The Kansas district showed the second largest reduction, with daily runs being cut back from 152,800 bbls. to 143,350 bbls. Although additional reduction in gasoline prices would no doubt cause some refiners to close down their plants, especially those of small refiners who purchase their crude supplies, none of the refiners in Kansas were planning to close down their plants this month. Daily runs in Barnsdall's plant are being reduced by 1,000 bbls., in Derby Oil Co.'s plant by 1,500 bbls., in Shell's Arkansas City plant by 4,000 bbls. and in Phillips' Kansas City plant by 850 bbls.

In North Central Texas runs are being lowered by almost 7,000 bbls., the greater portion of the decrease being due to the closing down of Taxman Refining Co.'s Wichita Falls plant. This plant has been sold to the Texas Railway Salvage Co. and, according to reports, the new owners may lease the plant instead of dismantling at this time. Gulf Oil Corp. is reducing runs in its Fort Worth plant by 1,600 bbls. and Continental Oil Co. is lowering daily runs in its Wichita Falls plant by 1,000 bbls. to account for much of the remainder of the decrease in that area.

North Louisiana Runs Higher

New production in Arkansas fields is causing refining activity in the North Louisiana area to move to a new high level as runs were increased by 3,560 bbls. to a total of 52,200 bbls. daily. The North Caddo refinery on the Louisiana side of the Rodessa field is now being operated at the rate of 1,200 bbls. daily. The plant was recently rebuilt and enlarged after being destroyed by fire. Runs in East Texas Refining Co.'s Sandra plant have been stepped up to 7,000 bbls. due to increased new production from the company's properties on the Arkansas side of the Rodessa field. In Arkansas, Root Petroleum Co. has raised daily runs in its El Dorado refinery by 500 bbls. due to new production in the Schuler field. This increase, however, was offset by a 700-bbl. cut in daily crude runs in Cross's Smackover plant so that total runs for the Arkansas district were lowered by 200 bbls.

In the East Texas district a reduction of 3,100 bbls. is being made as most refiners continue to operate at October levels. Daily runs in Talco Asphalt & Refining Co.'s plant are being raised 1,000 bbls. following the completion of its new cracking plant. General American Refining Co.'s Gladewater plant will be closed during November.

Mid-Continent Crude Runs

Average Daily (Barrels)

(Advance estimate compiled by The Oil and Gas Journal)

	1935	1936	1937
January	426,070	501,600	531,535
February	448,810	519,960	541,790
March	451,510	478,760	533,875
April	467,765	506,775	558,385
May	466,015	513,510	572,855
June	485,015	527,225	593,625
July	494,210	539,370	605,640
August	508,960	557,650	624,475
September	541,080	553,215	625,485
October	533,620	536,330	619,210
November	524,475	548,015	588,990
December	511,025	535,500	.....

Operations by Refinery Districts

Daily crude runs	Nov.	Oct.	Decr.
Arkansas	26,350	26,550	200
East Texas	67,960	71,060	3,100
Kansas	143,350	152,800	9,450
N. Central Texas	40,350	47,200	6,850
North Louisiana	52,200	48,640	*3,560
Oklahoma	158,430	173,105	14,675
Southwest Texas	22,050	22,515	465
W. Texas Panhandle	78,300	77,340	*960
Total	588,990	619,210	30,220

*Increase.

Estimated Daily Average Mid-Continent Refinery Crude Runs for November

ARKANSAS

Company and location—	Daily capacity	Av. dly. runs Nov.	Av. dly. runs Oct.
Berry Asphalt Co., Waterloo	2,000	750	750
Henry H. Cross, Smackover	6,000	4,300	5,000
Lion Oil Ref. Co., El Dorado	12,300	12,000	12,000
Macmillan Pet. Corp., Norphlet	2,500	2,000	2,000
Root Pet. Co., El Dorado	12,000	7,000	6,500
Stephens Ref. Co., Stephens	700	300	300
Total	35,500	26,350	26,550

KANSAS

Barnsdall Ref. Co., Wichita	6,000	4,000	5,000
Bay Pet. Co., McPherson	3,500	2,350	2,500
Chanute Ref. Co., Chanute	2,000	1,000	1,000
Chase Ref. Co., Chase	800	550	550
Cusco Oil & Ref. Co., Chase	3,100	(*)	(*)
Derby Oil Co., Wichita	8,000	4,500	6,000
El Dorado Ref. Co., El Dorado	5,000	3,500	4,000
Falcon Ref. Co., Inc., Great Bend	1,000	600	600
Globe Oil & Ref. Co., McPherson	12,500	12,500	12,000
Kanotex Ref. Co., Arkansas City	12,000	6,000	6,500
Kreuger Ref. Co., Natoma	150	50	50
National Ref. Co., Coffeyville	8,000	5,200	5,800
Pet. Products Co., Chanute	800	700	700
Phillips Pet. Co., Kansas City	23,000	17,600	18,250
Shallow Water Ref. Co., Scott City	1,500	1,500	1,500
Shell Petroleum Corp., Arkansas City	20,000	14,000	18,000
Sinclair Ref. Co., Coffeyville	20,000	8,700	9,000
Sinclair Ref. Co., Argentine	11,000	7,200	7,500
Skelly Oil Co., El Dorado	23,000	22,000	21,500
Socony-Vacuum Oil Co., Inc., Augusta	20,000	18,000	18,500
Standard Oil Co. (Indiana), Neodesha	20,000	10,100	10,500
United Ref. Co., Russell	1,200	600	600
Vickers Pet. Co., Potwin	3,500	2,700	2,750
Total	207,100	143,350	152,800

*Shut down.

EAST TEXAS

Beacon Oil & Ref. Co., Henderson	4,500	(*)	(*)
Cascade Ref. Co., Reed Switch	3,000	2,630	1,375
Clay Ref. Co., Arp	3,500	3,385	3,220
Danciger Refs., Inc., Longview	10,000	5,000	5,000
East Texas Ref. Co., Longview	10,000	6,500	7,000
General American Ref. Co., Gladewater	4,000	(*)	2,700
Hurricane Pet. Corp., Overton	5,000	3,360	3,565
Hurricane Pet. Corp., Arp Ref., Arp	3,750	3,095	3,485
Lacy Ref. Co., Kilgore	3,000	2,500	2,200
Magnolia Pet. Co., Corsicana	5,000	4,300	4,770
Martin Ref. Co., Gladewater	3,000	2,420	1,670
McMurrey Ref. Co., Tyler	10,000	2,530	3,560
Premier Oil Ref. of Texas, Willow Springs	4,500	3,000	3,000
Paluxy Asphalt Co., Talco	5,000	3,300	4,000
Sinclair Ref. Co., Camp Switch	6,000	3,100	3,100
Solvex Refs., Inc., Gladewater	4,500	3,000	3,500
Southport Pet. Co., Kilgore	5,000	3,000	3,000
Talco Asphalt & Ref. Co., Mt. Pleasant	7,000	6,500	5,500
Texas Co., The, Dallas	16,000	8,000	8,000
Tower Ref. Co., Overton	3,000	2,340	2,415
Total	116,750	67,980	71,060

*Shut down.

NORTH CENTRAL TEXAS

Allstate Ref. Co., Thrall	2,500	(*)	(*)
Baird Ref. Co., Baird	1,500	1,300	1,300
Bryson Ref. Co., Bryson	600	400	400
Coleman Ref. Co., Coleman	750	300	300
Continental Oil Co., Wichita Falls	6,000	3,165	4,135
Crown Oil Co., Fort Worth	1,000	(*)	(*)
Exchange Pet. Corp., Albany	800	200	200
Falls Ref. Co., Wichita Falls	2,000	300	300
Gainesville Ref. Corp., Gainesville	2,500	1,250	1,200
Gratex Ref. & Fuel Oil Co., Graham	500	300	300
Gulf Oil Corp., Fort Worth	8,000	5,200	6,800

Company and location—	Daily capacity	Av. dly. runs Nov.	Av. dly. runs Oct.
Hightower Oil & Ref. Corp., Brownwood	750	100	100
Jacksboro Ref. Co., Jacksboro	250	50	50
Kraco Ref. Co., Bryson	2,000	1,100	1,500
La Salle Pet. Co., Burkburnett	3,500	1,000	800
Magnolia Pet. Co., Fort Worth No. 1	12,000	5,600	5,650
Midway Ref. Co., Coleman	300	150	150
Norgold Ref. Co., West Olney	500	(*)	200
North Texas Oil & Ref. Co., Gainesville	600	300	300
Ohio Oil Co., Fort Worth	5,000	4,000	4,160
Olney Oil & Ref. Co., North Olney	3,000	1,500	1,800
Panhandle Ref. Co., Wichita Falls	4,200	2,500	2,800
Panhandle Ref. Co., Lueders	1,000	875	975
Sinclair Ref. Co., Fort Worth	5,000	2,800	2,865
Southland Ref. Co., Megargel	500	200	200
Taylor Ref. Co., Taylor	6,000	1,000	1,000
Taxman Ref. Co., Wichita Falls	3,250	(*)	3,000
Texas Pacific Coal & Oil Co., Caddo	1,000	800	800
Tucker Oil Co., Burkburnett	250	160	165
Tydal Ref. Co., Gainesville	1,850	1,600	1,750
Wagoner Ref. Co., Electra	6,000	4,000	4,000
Total	83,000	40,350	47,200

*Shut down.

NORTH LOUISIANA

Arkansas Fuel Oil Co., Bossier City	25,000	20,000	20,000
Atlas Pipe Line Co., Shreveport	12,500	9,000	9,000
Bayou State Oil Corp., Hosston	750	500	500
East Texas Ref. Co., Sandra	7,000	7,000	3,500
Griswold Refs., Inc., Shreveport	1,000	(*)	(*)
North Caddo Ref., Rodessa	1,500	1,200	640
Rodessa Oil & Ref. Co., Cedar Grove	8,000	7,000	7,500
Shoreline Oil Co., Lewis	5,000	3,000	3,000
Stanolind Oil & Gas Co., Superior	5,000	4,500	4,500
Total	65,750	52,200	48,640

*Shut down.

OKLAHOMA

Anderson-Prichard Ref. Corp., Cyril	6,500	6,000	6,000
Barnsdall Ref. Co., Barnsdall	6,000	4,500	4,500
Barnsdall Ref. Co., Okmulgee	10,000	(*)	(*)
Bell Oil & Gas Co., Grandfield	5,000	3,200	3,500
Black Gold Ref. Co., Oklahoma City	3,000	1,300	1,800
Champlin Ref. Co., Enid	16,000	9,500	10,000
Cities Service Oil Co., Okmulgee	4,000	2,200	2,500
Cities Service Oil Co., Ponca City	12,000	8,000	10,000
Continental Oil Co., Ponca City	30,000	19,000	19,000
Cushing Ref. & Gasoline Co., Blackwell	1,700	1,500	1,500
Cushing Ref. & Gasoline Co., Cushing	6,200	2,400	2,400
Cosco Oil Co., Wynnewood	2,500	2,000	2,000
Deep Rock Oil Corp., Cushing	10,000	9,000	9,000
Eason Oil Co., Enid	3,000	2,500	2,500
Globe Oil & Ref. Co., Blackwell	8,000	(*)	5,000
Johnson Oil Ref. Co., Cleveland	6,000	4,000	4,000
Mid-Continent Pet. Corp., West Tulsa	40,000	25,000	26,000
Ohio Oil Co., Bristow	5,000	3,000	3,000
Omar Ref. Co., Garber	4,000	2,500	2,800
Peppers Gasoline Co., Oklahoma City	500	400	450
Phillips Pet. Co., Okmulgee	6,500	5,330	5,480
Pure Oil Co., Muskogee	10,000	7,500	8,325
Pyramid Prod. & Ref. Corp., Oklahoma City	600	(*)	400
Rock Island Ref. Co., Beckett	6,500	5,000	5,500
Sinclair Ref. Co., Sand Springs	8,000	4,500	4,500
Sooner State Ref. Co., Oklahoma City	700	(*)	350
Sun Oil Co., Yale	5,000	2,000	2,000
Sunray Oil Co., Allen	6,500	3,000	3,225
Texas Co., West Tulsa	16,000	10,800	11,200
Tide Water Oil Co., Drumright	12,000	12,000	12,000
Triangle Prod. & Ref. Co., Oklahoma City	1,200	400	950
Vinita Ref. Co., Vinita	100	(*)	(*)
Wilcox Oil & Gas Co., Bristow	6,000	2,000	3,225
Total	258,500	158,430	173,105

*Shut down.

SOUTHWEST TEXAS

Amsco Ref. Co., Mirando City	4,500	3,500	3,500
Carle Ref. Co., Inc., San Antonio	1,000	600	600
Humble Oil & Ref. Co., San Antonio	5,000	3,400	3,500
Ina Oil & Ref. Co., Hondo	400	50	50
Magnolia Pet. Co., Luling	8,000	6,000	6,315
Pettus Oil & Ref. Co., Pettus	1,000	800	800
Pettus Oil & Ref. Co., Mathis	1,000	800	750
Phoenix Ref. Co., San Antonio	1,200	800	1,000
Phoenix Ref. Co., Bruni	900	600	600
Pioneer Oil & Ref. Co., Somerset	2,000	900	900
Rado Ref. & Prod. Co., McAllen	800	750	500
Texas Co., San Antonio	3,000	2,700	2,800
Valley Ref. Co., Harlingen	1,000	700	700
White Wing Ref. Co., Sullivan City	1,000	450	500
Total	30,800	22,050	22,515

WEST TEXAS AND PANHANDLE

Aero Gas Ref. Co., Pecos	225	100	100
Coltex Ref. Co., Colorado	12,500	8,000	8,000
Concho Ref. Co., San Angelo	250	100	100
Cosden Oil Co., Big Spring	15,000	9,000	9,500
Danciger Refs., Inc., Pampa	6,500	5,000	5,000
Danube Oil Corp., Borger	400	300	400
Gibson Oil Corp., Magic City	250	100	150
Gulf Oil Corp., Sweetwater	7,000	6,500	5,500
Howard County Ref. Co., Big Spring	2,000	1,000	1,000
Moutray Oil Co., Hawley	1,400	1,030	1,150
Onyx Ref. Corp., Abilene	2,000	1,500	2,000
Panhandle Ref. Co., Kings Mill	2,500	1,700	1,800
Paward Ref. Co., Shamrock	750	400	400
Phillips Pet. Co., Borger	50,000	23,330	21,800
Sageland Ref. Co., Sweetwater	1,000	500	500
Shamrock Oil & Gas Corp., Sunray	2,500	1,500	1,500
Shamrock Oil & Gas Corp., Meldavis	1,600	1,600	1,700
Stamford Ref. Co., Stamford	400	400	300
Standard Oil Co. of Texas, El Paso	14,000	8,300	8,300
Starlight Ref. Co., Ballinger	500	200	200
Texas Co., El Paso	2,000	1,300	1,300
Texas Co., Amarillo	6,000	3,200	3,100
West Texas Ref. Co., Pecos	6,000	1,600	1,600
Western Ref. Co., Mertzon	1,000	400	400
West Texas Oil & Ref. Co., Sweetwater	60	40	40
Wickett Pet. Co., Wickett	3,000	1,200	1,500
Total	131,535	78,300	77,340

Bituminous Mat on Shoulders Used to Widen Highways

Highway widening programs designed to give motorists added safety at today's high speeds are under way in several southwestern states, a recent survey reveals. The U. S. Bureau of Public Roads recently reported highways less than 22 feet wide are inadequate and unsafe for modern traffic, and many of the 18-foot pavements, now obsolete from a safety viewpoint, are being widened by bituminous mat treatment on each side of pavement.

Oklahoma and Texas highway departments have widening programs in progress, and it is reported that Texas will spend about $3,000,000 in adding bituminous shoulders to its narrower roads. In Oklahoma, U. S. Highway No. 66, one of the heaviest traveled in the state, is being widened by the same process.

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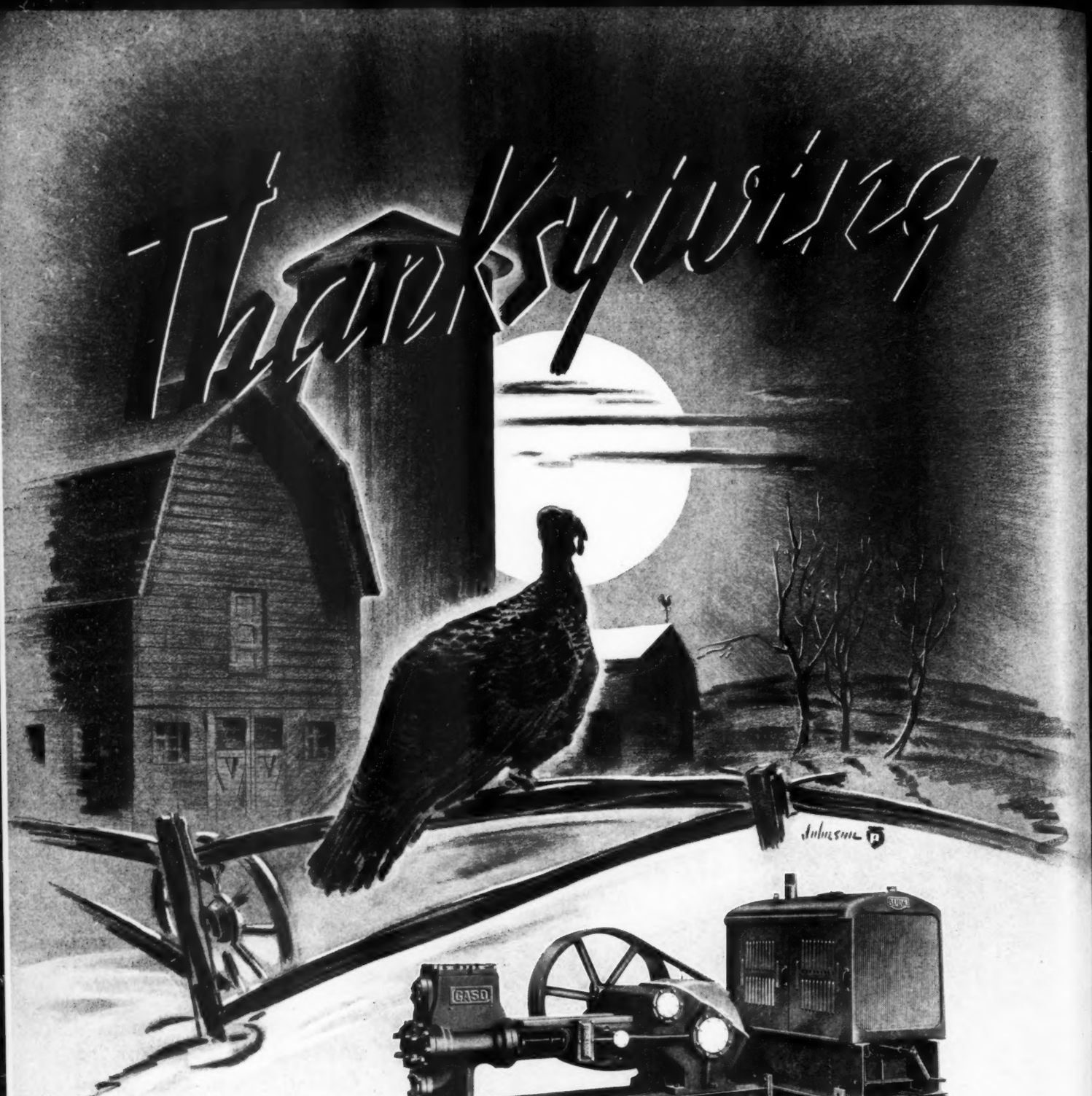

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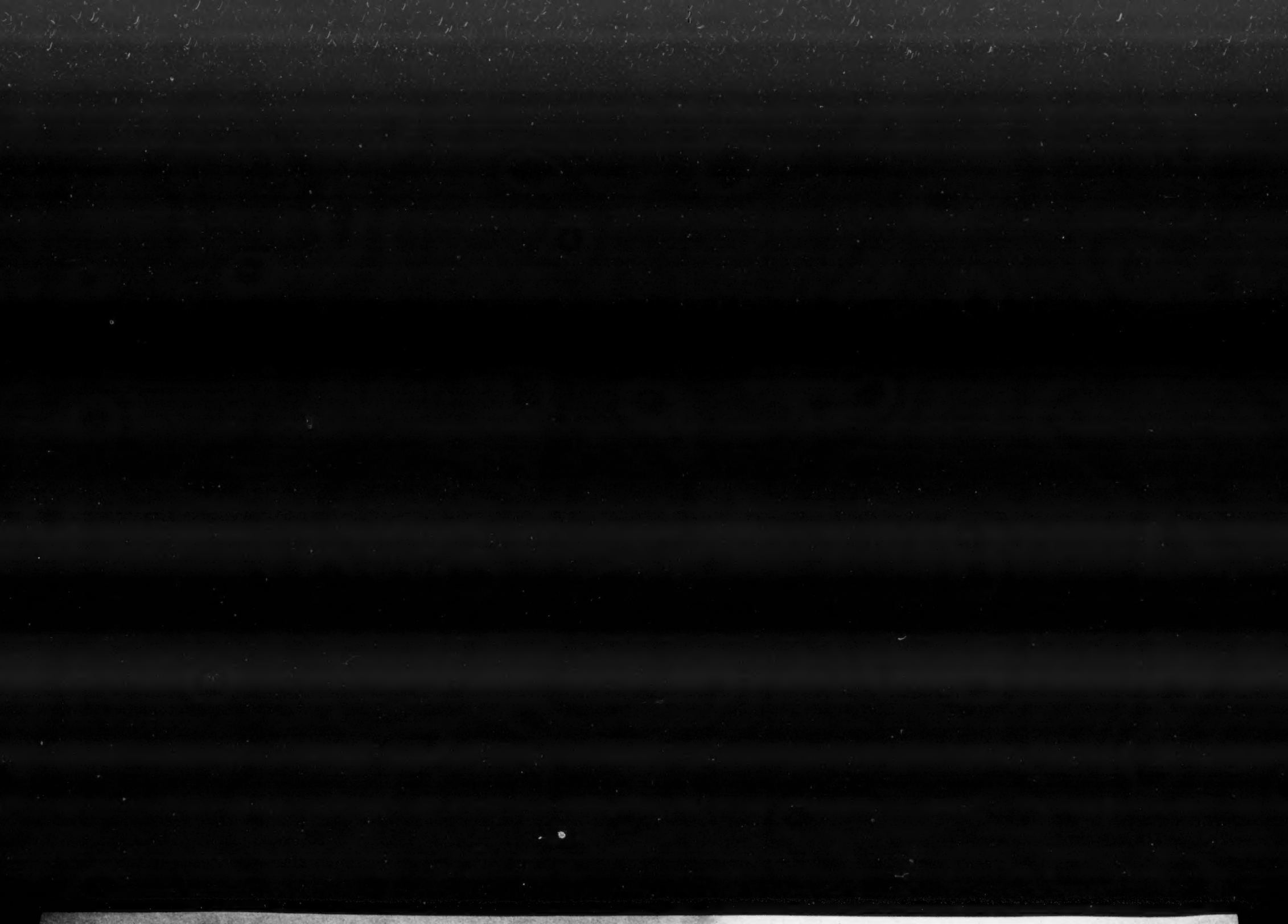


FIELD OPERATIONS

Summarizing the Week's Developments

The most important oil discovery in the United States in the past week was that of Union Oil Co. in Kern County, California, which opened a high-gravity oil pool in section 34-28-25, at a total depth of 11,302 feet. The well gauged 1,340 bbls. of oil in 24 hours through a one-eighth inch orifice. The well is estimated by some experienced observers to be potentially good for 10,000 bbls. a day on open flow. The oil has a gravity of 39.4 degrees. The well is the deepest producer in the state. It is located a few miles northwest of the Ten Section field and 5 miles northeast of the town of Rio Bravo.

TEXAS

A new sand was uncovered in the Seven Sisters field in Duval County, Texas. A well starting at 22 bbls. per hour opened the Nash Creek field southeast of the Darst Creek field. A test on the south flank of the old Orange field in Orange County is showing oil and may open a lively drilling campaign thereabouts. A dry hole at 7,696 feet was completed in the Hardin field in Liberty County. A new pool producing relatively heavy oil was opened in Pecos County, 8 miles southwest of Fort Stockton. Cochran County's Duggan pool was extended a mile easterly and the Denver pool in Yoakum was given a 1½-mile extension. The Avoca pool in Jones County was extended on the northeast but defined on the south by a dry hole.

OKLAHOMA

A 4,538-bbl. oil well, which also produced 12,000,000 feet of gas, was completed in section 4-19-2w, south end of Lucien field in Logan County, Oklahoma. A wildcat in section 8-5-10, near Calvin, Hughes County, showed saturation in cores and produced 10 bbls. of oil in 12 hours while coring, with 21,200,000 feet of gas. Extension of the Wellston pool, Lincoln County, one-fourth mile west, was indicated.

TEX-LA-ARK

Governor Bailey of Arkansas caused a delay in Redessa proration in Miller County as he does not favor restricting Arkansas oil production "at this time." The discovery well in Columbia County, Arkansas, continues to increase in production and was flowing at the rate of 552 bbls. a day.

Two fields were added to the Coastal Louisiana district. The Abbeville gas and distillate pool in Vermilion Parish was converted into an oil producing area by a well flowing 360 bbls. a day through a three-sixteenths inch orifice and the Quarantine Bay Prospect in Plaquemines Parish was assured commercial production.

NEW MEXICO

Extension of the Vacuum area of Lea County, New Mexico, 3 miles southward, was indicated by the showing in a well in section 1-18-34. A wildcat 3 miles northeast of the Cooper pool in section 31-23-37, was showing as a producer. Two other Lea County wildcats in sections 27-23-36 and 24-17-32, were showing oil.

KANSAS

A discovery well in section 12-22-13w, 3 miles southeast of the Gates pool of Stafford County, Kansas, pumped 135 bbls. of oil in three hours. The Wilcox sand discovery in section 18-28-1e, Sedgwick County, pumped 475 bbls. of oil in 16 hours. A wildcat in section 7-30-1e, Sumner County, was swabbing at the rate of 75 to 100 bbls. of oil daily. Three oil pool openers were completed the past week.

Completions in All Fields

(Week Ending November 6, 1937)

	Oil	Gas	Dry	Total	1937 total comp. to date	1936 total comp. to date
N. Y., Pa., W. Va	70	30	6	106	3,859	3,381
Ohio	11	10	13	34	1,034	679
Indiana	2	8	7	17	105	163
Kentucky	15	19	9	43	600	269
Illinois	10	0	2	12	231	35
Michigan	19	0	7	26	687	716
Kansas	47	5	14	66	2,254	1,444
Oklahoma	23	3	12	38	2,298	2,255
Texas:						
North Central Texas	26	1	16	43	2,398	2,361
West Texas	41	0	4	45	2,294	1,371
Texas Panhandle	19	4	0	23	683	570
East Texas	57	0	1	58	2,038	2,228
East Central Texas	15	0	2	17	626	324
East Texas Border	6	0	3	9	295	129
Gulf Coast Texas	22	1	7	30	1,331	1,074
Southwest Texas	40	4	15	59	2,800	2,499
Total Texas	226	10	48	284	12,465	10,556
North Louisiana	16	0	1	17	564	586
Gulf Coast Louisiana	4	0	5	9	386	353
Total Louisiana	20	0	6	26	950	939
Arkansas	7	0	0	7	149	75
Montana	3	0	1	4	196	213
Wyoming	2	0	0	2	93	102
Colorado	0	0	0	0	17	24
New Mexico	6	1	0	7	609	491
Utah	0	0	0	0	3	5
California	20	0	7	27	1,289	989
Total United States	481	86	132	699	26,839	22,336
Total previous week	454	54	139	647		
Difference	27	32	7	52		

Outstanding Fields—Highlights

(Week Ending November 6, 1937)

FIELD—	Rigs up	Wells drlg.	Weekly oil completions	Initial prod.	Total No. oil wells	Daily av. prod.
TEXAS						
Hastings	5	23	7	3,603	357	21,400
McCampbell	1	13	3	600	79	4,170
Saxet	3	18	3	425	562	44,875
Benavides	4	9	4	550	85	9,180
East Texas	64	97	57	2,664	26,875	484,897
Talco	7	23	10	2,509	540	35,100
Ector County	17	96	10	11,374	707	32,000
Winkler County	7	38	10	5,195	1,482	44,400
OKLAHOMA						
Fitts	5	19	4	541	913	69,650
Billings	0	6	2	1,244	56	7,900
KANSAS						
Barton County	15	43	13	8,601	258	8,370
Ellis County	6	30	2	3,355	239	7,675
Russell County	14	51	13	15,397	925	35,405
Rice County	14	33	3	1,116	1,015	31,300
NEW MEXICO						
Lea County	16	111	6	471	1,515	96,730
LA-ARK-TEX						
Rodessa, Ark.	4	20	7	4,632	37	14,424
Rodessa, La.	2	10	3	890	417	40,914
Rodessa, Tex.	2	19	6	1,559	363	27,334
Lisbon, La.	3	13	4	4,720	143	3,270
Jennings, La.	2	14	1	250	73	8,416
MICHIGAN						
Buckeye	8	60	5	3,155	283	27,162
CALIFORNIA						
Wilmington	11	27	5	2,307	297	57,950
ILLINOIS						
Central Illinois	46	104	10	2,984	183	16,789

Central West

By STAFF CORRESPONDENT

NEW OPERATIONS INCREASE IN CENTRAL BASIN DISTRICT

MATTOON, Ill., Nov. 8.—Twenty-two first reports of new operations, including locations, rigs and drilling, were recorded in the Central Basin fields in the past week against 12 completions. The number of rigs up and wells drilling at this time exceeds any week's record this year. Wildcatting is extending, notwithstanding unsuccessful attempts to find commercial production thus far in the counties outside of Clinton, Clay, Marion, Wayne and Richland counties.

Completed Wells

In Clay County, Graham & Duncan No. 3 Land Bank, NW SE NE section 8-2n-8e, had pay at 2,980-3,023 feet, which was acidized with 1,500 gallons. It pumped 420 bbls. of oil on the first 24-hour test.

Pure Oil Co. No. 2 Brissenden, SW NE NE section 8-2n-8e, flowed 350 bbls. the first 24 hours from pay at 3,000-05 feet, total depth 3,020 feet.

Pure Oil Co. No. 1 Wilkins, NE NE SW section 28-3n-8e, had Ste. Genevieve lime at 2,906 feet, set 7-inch casing at 2,940 feet, total depth 3,030 feet. It flowed 123 bbls. the first day.

Pure Oil Co. No. 2 A. L. Moseley, NW NE NE section 33-2n-8e, is a 250-bbl. well at 2,975-81½ feet, total depth 2,997 feet.

In Marion County, Boswell and others No. 1 Smith, NE cor. NW SW SE section 28-4n-1e, was dry and abandoned at 1,466 feet. It swabbed a little oil and salt water from sand at 1,416-66 feet.

Adams Oil & Gas Co. have a 60-bbl. well in No. 13 Merryman, C NW NW section 28-4n-1e, producing from 1,385-95 feet, total depth.

Adams Oil & Gas Co. No. 2 Frayer, CNL NE SW section 21-4n-1e, is a 15-bbl. pumper at 1,421-31 feet, total depth.

In Richland County Ohio Oil Co. No. 5 Arbuthnot, NW NW NE section 8-3n-9e, flowed 1,053 bbls. in 20 hours from pay at 2,960-79 feet, total depth. Later it flowed 1,206 bbls. in 24 hours.

J. I. Staley abandoned the location for No. 1 Public Park, in Noble County, after having dug cellar and pits.

Charles L. McMahon No. 1 Federal Land Bank, SW SE NW section 27-4n-9e, was dry and abandoned at 3,007 feet.

Pure Oil Co. No. 1 Tatum, SE NE NE section 33-4n-9e, started at 313 bbls. a day from pay at 2,976-87 feet.

Mammoth Producing & Refining Co. No. 3 Standford-Heitz, NW SW NW section 34-4n-9e, with sand at 2,980-3,000 feet, flowed 350 bbls. in 24 hours.

In Wayne County, Benedum & Trees, Inc. No. 1 Knapp, SE NW SW section 33-2n-7e, is a 50-bbl. pumper producing from sand at 3,144-51 feet.

New Field Work

As usual in Illinois this year the new work reported was greatly in excess of the wells completed.

In Bond County, Universal and DeMayo made a location for No. 1 Molden, 320 feet from north and west lines of section 24-6n-4w.

In Christian County, Rogers Brothers and others have rotary rigged up for No. 1 Johnson, NE SE SE section 27-12-2w. It is to be a 3,500-foot Trenton lime test.

In Clay County, Pure Oil Co. made a location for No. 4 S. Bechtel, NW SE NW section 33-3n-8e, and for No. 3 A. Travis, C S half N half NW section 33-3n-8e; has derrick up for No. 2 L. Clark, SE NW SE section 8-2n-8e, and has rotary rigged up to start No. 2 F. Hubbels, NW SE SE section 8-2n-8e.

In Clinton County, A. C. McBride was moving in material for No. 1 F. F. Schuette, SW cor. NE section 3-2n-4w, and Holle & Wiles made a location for No. 1 Meuf, 600 feet from north and 200 feet from east lines of section 18-3n-2w.

In Marion County, Adams Oil & Gas Co. made a location for No. 15 Merryman, CSL N half SW section 21-4n-1e. R. E. Dalton was rigging up rotary for No. 1 Clinton, NE NE SW section 15-1n-4e.

In Richland County, Joe Fitzgerald was building rotary derrick for No. 1 Ingle, NE NW NW section 16-3n-9e. Louis Godlin and P. Huffman had derrick up for No. 1 E. Shannon, CEL SE NE section 17-3n-9e. Ray & Alford have derrick up for No. 1-A Franklin, NW NW NW section 34-5n-1e. Louis Godlin and others were drilling No. 1 Garrett, C W half SE SE SE section 8-3n-9e. J. E. Milburn has cellar dug for No. 1 Travis & Fleming, CEL SE NE NE section 17-3n-9e. Pure Oil Co. staked location for No. 1 John L. Moore, NW NW NW section 23-3n-8e. Wiser Oil Co. has cellar and pits dug for No. 1 Travette and others, C N half NE SE section 8-2n-10e. Sam Raitman staked location for No. 1 Richey, C NE NW section 12-4n-14w, measuring from Indiana principal meridian. Hollingsworth Oil & Gas Co. No. 1 Waggoner, NE NW NW section 5-3n-14w, has derrick up.

In Shelby County, Doyle Oil Co. will make a McClosky test in No. 1 McClory, SE SE NE section 14-10-6e, and has derrick up.

In Williamson County, Edward C. Snyder made a location for No. 1 Fleming, C SE NW section 9-10s-8e.

In Wayne County, Pure Oil Co. made a location for No. 1 Anna Gill and others, SW SW NE section 27-2n-8e.

Among the Wildcats

In Bond County, J. M. Huber Corp. No. 1 Kunz, SE NW NW section 11-6n-5w, was drilling Trenton limestone at 2,870 feet.

In Christian County, Parshall No. 1 Yockey, SW SW NE section 36-15n-2w, drilled to 2,824 feet, and plugged back to 1,960 feet. Casing was set at 1,940 feet and a showing at 1,946-52 feet will be tested.

In Cumberland County, Jolly and others No. 1 Jenkins, SE NE NE section 30-10-9e, was running 6-inch casing to 1,557 feet, total depth.

In Effingham County, Kingwood Oil Co. No. 1 Bartel, C W half NE NW section 26-6n-5e, was drilling at 3,565 feet. It had Ste. Genevieve lime at 2,465 feet and small showings of oil at 3,400-20 feet and 3,500-10 feet.

In Fayette County, Oil Development Co. No. 1 Vance, SE SE SE section 16-7n-2e, had dry Bethel sand at 1,908-13 feet and was drilling at 2,024 feet. Carter Oil Co. No. 1 Miller, C W half NW NW section 12-8n-3e, set 5⅛-inch casing at 3,064 feet. It topped Devonian limestone at 3,072 feet. After drilling plug the hole was bailed dry. It showed only a little oil and may be acidized.

In Hamilton County, Carpenter and others No. 1 Clark, NW NW SW section 32-3s-5e, had tools stuck in the hole at 3,324 feet, total depth. The crew will shoot off the drill pipe. J. Garfield Buell and others No. 1 Dickey, SE SE SW section 22-3s-7e, was circulating at 3,000 feet after making repairs.

In Jasper County W. R. Anderson was shut down at 3,220 feet in No. 1 Hetzger, C W half NE SE section 10-7-8e. The hole may be drilled deeper.

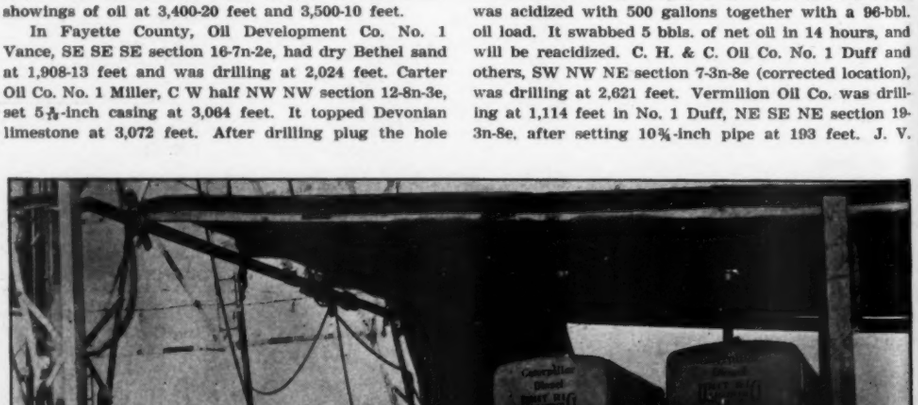
In Jefferson County Carter Oil Co. No. 1 Tate, C W half NW NE section 10-1s-2e, had Ste. Genevieve lime at 2,180 feet but was shut down at 2,962 feet waiting for water.

In Marion County T. M. Connery and others No. 1 Thalman, NE cor. NW NW NE section 9-3n-1e, was coring lime at 1,500 feet. It had Stein sand at 1,370-1,400 feet. Alexander and others No. 2 Allison, NW SW SW section 33-4n-1e, swabbed mostly water and when put on the pump produced only salt water and is shut down for orders. Eddington, Parker & Baldwin No. 1 Nichols, CEL SW SE section 12-4n-4e, was drilling at 2,606 feet, with the hole full of water.

In Richland County, Pure Oil Co. No. 1 Frost, SE cor. SW SW SW section 9-3n-9e, had St. Louis at 3,091-98 feet, total depth. It flowed and cleaned itself in three heads and when swabbed produced 69 bbls. of oil in 14 hours. It will be acidized. Carter Oil Co. No. 3 Watkins, NE NE SE section 33-4n-9e, topped Ste. Genevieve limestone at 2,927 feet and was reaming to 3,015 feet, total depth. It cored some saturation at 1,998-3,015 feet. Pure Oil Co. No. 1 Correll, NW NE SE section 33-4n-9e, was drilling at 3,038 feet. It had a showing at 3,014-16 feet.

In Wayne County Duncan Brothers were testing a showing of gas in No. 1 Riggs, NW NW SE section 27-2n-8e, total depth 3,040 feet.

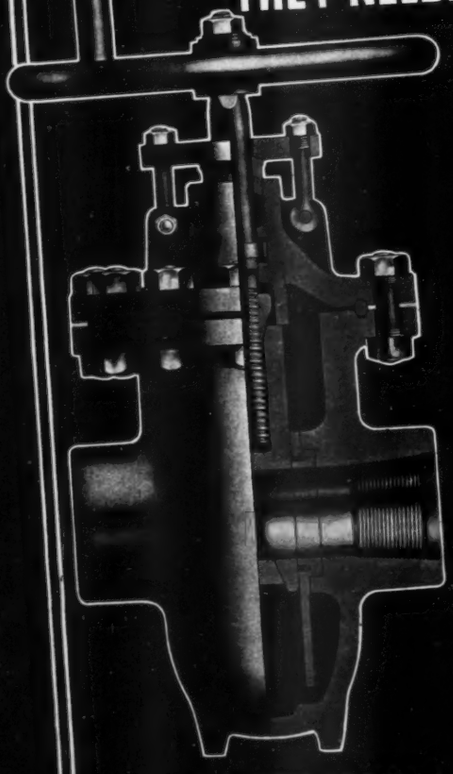
In Clay County Gordon Oil Co. No. 3 Land Bank, SW NE SE section 8-2n-8e, had pay at 2,994-3,005 feet, total depth 3,006 feet, and was flowing into pits. No gauge was taken. Pure Oil No. 3 Scrugham, SW NW NW section 9-2n-8e, had pay at 2,985½-88½ feet, which was acidized with 500 gallons together with a 96-bbl. oil load. It swabbed 5 bbls. of net oil in 14 hours, and will be reacidized. C. H. & C. Oil Co. No. 1 Duff and others, SW NW NE section 7-3n-8e (corrected location), was drilling at 2,621 feet. Vermilion Oil Co. was drilling at 1,114 feet in No. 1 Duff, NE SE NE section 19-3n-8e, after setting 10¾-inch pipe at 193 feet. J. V.



Diesel-mechanical rotary drilling rig being used by Olson Drilling Co. on a test of the Pure Oil Co. in the Noble field of Illinois

Spraying the trees at Caddo

THEY NEEDED THE W-K-M VALVE CLASS OF CONTROL



They had more volume than control in the hey-day of Caddo, when high pressures from shallow depths sprayed the surrounding countryside with almost every completion. And it wasn't altogether for the amusement of the spectators. These operators needed faster and surer control . . . the W-K-M Gate Valve class of control. How handy this Valve would have been! . . . the design of which not only antiquates valve equipment of the Caddo days, but which is definitely in a class by itself among gate valves today. This is not alone our opinion, but the concensus of opinion of leading operators everywhere who are responsible for its being the fastest selling gate valve in the oil country.

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Wicklund was shut down at 3,175 feet in No. 1 McCauley, SW SW SE section 23-3n-8e. Pure Oil Co. No. 1 J. C. Bressenden, NW SE NW section 27-3n-8e, had Weller sand at 2,615-40 feet, and was drilling at 2,752 feet. Pure Oil Co. No. 4 E. Chaffin, NE NW SW section 27-3n-8e, had Ste. Genevieve lime at 2,916 feet and pay at 2,973-89 feet. It was acidized with 1,000 gallons loaded with 125 bbls. of oil. It swabbed 73 bbls. net in 24 hours and was reacidized with 3,000 gallons. Pure Oil Co. No. 6 Charles Wilson, SW SW SE section 28-3n-8e, had pay at 2,969-70 feet and 3,002-03½ feet. It was acidized with 500 gallons and swabbed 98 bbls. gross oil and swabbed down. Later it swabbed and flowed 61 bbls. gross. Then it was reacidized with 1,000 gallons and swabbed 98 bbls. gross in 20 hours and swabbed down. Later it swabbed 9.46 bbls. in two hours. The crew was testing. Wiser Oil Co. No. 11 D. Smith, NE SW NE section 28-3n-8e, was drilling at 2,950 feet. It had saturated Dolomite at 2,900-06½ feet. Pure Oil Co. No. 1 Almon Moseley, NE SW NW section 33-3n-8e, had pay sections from 2,958 to 2,966 feet, total depth 2,980 feet. It swabbed five hours and after a 12-hour shutdown resumed swabbing for two hours and then the well flowed. There was no gauge. Pure Oil Co. No. 1 George L. Travis, SE SE SW section 33-3n-8e, found Weller sand at 2,631-42 feet, dry, and was drilling at 2,678 feet.

In Clinton County Bartelso Oil Co. No. 3 Schlorman, NE cor. NW SE SE section 2-1n-3w (corrected location), was fishing at 750 feet. McClanahan Oil Co. No. 1 Pearl Hester, SE cor. NE NW SW section 26-3n-1w, was drilling in mud at 950 feet.

In Edwards County Leach Brothers No. 1 A. D. Lee, SW NE SE section 11-1s-10e, was drilling at 2,616 feet.

In Lawrence County, Strauss and others No. 1 Robeson, NW SE NE section 16-3n-10w, measuring from Indiana Central meridian, was drilling at 2,620 feet.

In Pope County C. C. Whitlock and others No. 1 Anthis, SE cor. NE NW NE section 12-11s-5e (corrected location), was shut down at 1,352 feet.

In Richland County Pure Oil Co. No. 1 Schneider was drilling at 2,210 feet. Pure Oil Co. No. 5 Palmer-Taylor, NW SW SE section 5-3n-9e, set pipe at 2,932 feet. It had pays at 2,951-60 feet, total depth 2,977 feet. Fortney Oil Co. No. 1 Warden, SE half SE SE section 8-3n-9e (corrected location), flowed 232 bbls. of oil in eight hours after a 3,000-gallon acid treatment. Pay was at 2,940-57 feet. W. F. Lacey No. 1 Galloway, SE SE SE section 8-3n-9e, was drilling at 2,540 feet. Ohio Oil Co. No. 6 Arbuthnot, NE NW NE section 8-3n-9e, was drilling at 1,755 feet. Pure Oil Co. No. 1 Wilson, NW NE NE section 8-3n-9e, was drilling at 2,309 feet. Roberts and others No. 1 Hanna and others, CWL SE SE SE section 8-3n-9e, was drilling at 2,560 feet. J. I. Staley No. 1 Mitchell, SE SE SE section 8-3n-9e, is a rig. Max Pray No. 1 Bahr, NW cor. SE NW section 16-3n-9e, was drilling at 2,035 feet. Southern Illinois Petroleum Co. No. 2 Allard, C E half SE NW NW section 16-3n-9e, drilling at 2,430 feet; Mammoth Producing & Refining Co. No. 1 McCauley, SW SE NW section 28-3n-9e, drilling at 2,780 feet; Bell, Loving & Co. No. 1 Blue Ridge Church, NE cor. SE section 26-4n-9e, moving in rotary; Mammoth Producing & Refining Co. No. 5 Stanford-Heitz, SW NW NW section 34-4n-9e, drilling at 760 feet; Kingwood Oil Co. and McMahaon No. 1 M. Negley, rig up in section 31-5n-9e.

In Saline County Will Rogers and others was drilling at 790 feet with a hole full of water in No. 1 Saylor, SE SE SE section 3-10s-6e.

In White County, Davis & Harrell No. 1 Poorman, NE NW NW section 5-4s-8e, was drilling at 2,100 feet.

In Wayne County, Benedum-Trees, Inc., No. 1 Craig, SE SE SW section 28-2n-7e, was drilling at 540 feet. Same company No. 1 Rosa Yates, SW NE SE section 33-2n-7e, is a rig. J. C. Shaffer No. 1 Shannon, NW NE SE section 26-2n-8e, is a location.

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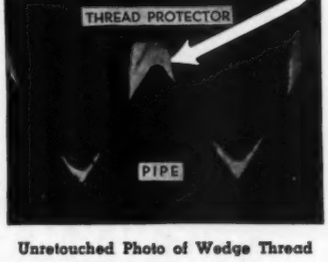

Unretouched Photo of Wedge Thread thru Carl Zeiss Toolmakers' Microscope

WEDGE PROTECTORS—

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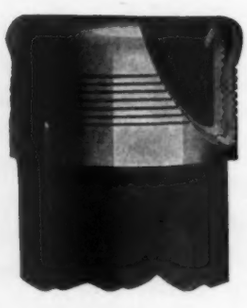

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Are easy to start

WEDGE PROTECTORS, INC. 9522 RICHMOND AVE., CLEVELAND, OHIO

OHIO

FINDLAY, Ohio, Nov. 8—Eleven oil wells, 10 gas wells and 13 dry holes were completed in the Central Ohio fields in the past week.

In Ashland County, Hanover Township, section 14, Mehowa Oil & Gas Co. completed No. 3 Leo Henley in Clinton sand. It is a gas well good for 3,900,000 feet at a total depth of 3,745 feet.

In Athens County, Athens Township, section 31, Gross and McCune No. 2 E. G. Campbell made 650,000 feet of gas and 3 bbls. of oil, from Berea sand, total depth 1,173 feet. In Lodi Township, section 12, C. W. Nuzum drilled No. 2 Amos Hixson to the second Berea sand. It is a 100,000-foot gas well; sand at 1,609-1,625 feet. In the same township, section 11, A. D. Townsend drilled No. 1 William S. Kelly to the second Berea and got a dry hole, total depth 1,805 feet. In the same township, Fraction 7, C. A. Cody No. 4 Oliver F. Lowther had a hole full of water in the Stray sand, and was abandoned at 995 feet. In Rome Township, Milhone, in section 29, found no Maxon sand in No. 11 O. O. Bryson and abandoned it at 950 feet. In the same township, section 18, Williams Brothers, No. 2 Wm. Phillips, found a hole full of water in the Injun sand and abandoned at 1,010 feet. In the same township, section 3, Ohio Fuel Gas Co. No. 1 Wm. Cohen, drilled to 1,300 feet. No Injun or Squaw sand was found. The hole was abandoned.

In Belmont County, Somerset Township, section 2, Huntsman and Peters completed No. 1 William Schneider, a gas well gauging 2,500,000 feet from Keener sand, topped at 1,277 feet, total depth 1,293 feet.

In Cuyahoga County, Independence Township, section 8, Walker and others No. 1 Clara Carey was abandoned at 2,515 feet. No Newburg sand was found.

In Fairfield County, Walnut Township, section 33, City Natural Gas Works drilled No. 3 A. O. Lamb to the Clinton horizon. It was a dry hole.

In Guernsey County, Washington Township, section 8, George Jewell completed No. 1 William Davidson for a gas well gauging 350,000 feet from the second streak of the Berea Grit. The top of the pay was at 1,411 feet and they drilled two feet in. In Monroe Township of the same county, section 23, George Jewell drilled the Chas. A. Branniger No. 3 to the Berea for a dry hole. The total depth of the hole was 1,298 feet.

In Knox County, Union Township, section 4, Preston Oil Co. completed No. 1 Helen Fesler in Clinton sand for an oil well making 130 bbls. the first 24 hours after a shot. The Clinton was found at 2,774-2,820 feet.

In Licking County, Mary Ann Township, section 14, G. H. Long completed No. 2 Nathan Loper in the Berea for a 3-bbl. oil well, top of the sand at 658 feet.

In Medina County, Homer Township, section 14, Edson and others completed No. 2 Clayton Billman in the Clinton sand, a gas well, good for 140,000 feet. The total depth was 2,804 feet.

In Monroe County, Wayne Township, section 14,

Cronin and others drilled the No. 4 Cronin to the Keener. It was for an oil well. It made 3 bbls. and some gas the first 24 hours after shot. The total depth was 1,226 feet.

In Morgan County, Windsor Township, Lot 1,091, Blind Brothers found no Cow Run sand in the No. 3 Clifton Blind. It was drilled to a depth of 406 feet and abandoned. In the same township, Lot 1,097, Burt & Son, on No. 12 S. B. Minor completed a 2-bbl. oil well in the Peeker sand, total depth of 505 feet.

In Muskingum County, Harrison Township, section 30, Sutton Bros. found Clinton sand dry in No. 1 Ray Dedrick, and had a show of oil in the Medina. It is now making 5 bbls. of oil per day. The Clinton was found at 4,153-4,202 feet and the Medina at 4,230-4,264 feet. In Licking Township of the same county, Scott and others completed No. 4 William Myers for a 100-bbl. oil well in the Clinton. The top of the sand was at 3,237 feet. In Wayne Township of the same county, section 2, the Hopewell Oil & Gas Co. completed an oil well in the Medina formation on the E. R. Myers No. 1. The well made 20 bbls. the first 24 hours after shot. The Clinton was found at 4,197-4,231 feet, dry, and the Medina from 4,276-4,292 feet.

In Perry County, Clayton Township, section 18, the Mid-East Gas Co. drilled the No. 2 Emma E. Williams to the Clinton and made 100,000 feet of gas and 1 bbl. of oil after shot. It was shut in on the casing at a total depth of 3,209 feet. In the same township and county, the Ohio Fuel Gas Co. completed No. 1 William H. Pettit for a gas well in the Clinton sand gauging 1,360,000 feet. The Clinton was from 3,160-3,176 feet.

In Scioto County, Jefferson Township, section 35, Dollar Oil & Gas Co. drilled No. 1 Richard Graves for a dry hole at 830 feet.

In Washington County, Liberty Township, section 20, Depuy Bros. completed No. 2 Stegner, a small gas well in Germantown sand, total depth 1,156 feet. In Ludlow Township, section 32, Henning & Hall drilled No. 3 J. S. McKee to 1,561 feet and found a gas well in the Squaw sand, making 150,000 feet. In Palmer Township, Lot 1,077, Swinger and others drilled the No. 34 Clarence Palmer to the Cow Run sand, total depth 571 feet. No production was found. The same operator, on the same tract, had a show of oil in the Cow Run sand in his No. 35. It was abandoned at 582 feet. On his No. 36, the same operator on the same tract, found 3 bbls. of oil the first 24 hours after shot in the Cow Run sand, total depth 615 feet.

In Wayne County, Canaan Township, section 22, Preston Oil Co. drilled a gas well on the J. W. Scholl No. 2 deeper to the second Clinton for a 32-bbl. oil well, total depth 3,279 feet. In Paint Township of the same county, section 24, the Ohio Fuel Gas Co. completed the No. 1 Edward Schwarm for a small gas well in the Clinton; the total depth was 4,172 feet.

EASTERN KENTUCKY

ASHLAND, Ky., Nov. 8.—Nine oil well completions and 15 gas well completions are included in this week's report from Eastern Kentucky.

One oil well completion, No. 9 on the Andrew Combs land in Lee County, is outstanding as it is a 200-bbl. well, brought in by C. A. Townsend, agent.

Included in this report are several gas wells better than 1,000,000 feet per day, all located in Floyd County. Five wells are reported as gassers in Martin County and the others are scattered.

The complete operations, by counties, follows:

Knott County

Warfield Natural Gas Co. completed No. 4,755 on the Laura Frazier farm on Right Fork of Troublesome Creek at total depth of 2,942 feet in shale. It gauged 331,000 feet of gas per day.

Operator Hamilton completed No. 11 Balis Everage, on Troublesome Creek, at total depth of 2,753 feet, a 244,000-foot gas well.

Stephens and others completed No. 1 Lee Gearhart, on Ball Fork, at 2,808 feet, good for 130,000 feet of gas per day.

Floyd County

Warfield Natural Gas Co. No. 4,747 Mable S. Agassiz on Dicks Creek is a 6,700-foot gasser at a total depth of 2,958 feet. The same company's No. 4,743 Melvin Endicott on Home Branch of Buffalo Creek, started at 83,000 feet of gas per day at a total depth of 2,633 feet.

The Southeast Gas Co. No. 3 Joseph Dillion on Ivy Creek, total depth 1,156 feet is good for 1,896,000 feet of gas per day. Fred Williams No. 1, Mrs. Woods' land at Betsey Lanye at a total depth of 1,510 feet, in Big Lime, came in for 2,000,000 feet of gas daily. Same operator No. 5 Stanley Heirs on Levisa Fork, at 2,790 feet, in shale, was completed. It made 100,000 feet of gas per day.

Operator Hamilton completed No. 4 James Hatcher D-75 on Dropping Lick Branch at 1,567 feet in Maxton sand. It started at 1,497,000 feet of gas.

Fred Williams No. 6 Stanley Heirs, total depth of 2,689 feet, in shale, started at 786,000 feet of gas per day. This well is on Mare Creek. Fred Williams No. 2 W. Honaker on Camp Branch, total depth 2,000 feet, in Big Lime, was a 25-bbl. oil well.

Francis and others No. 1 Booker Jones on Camp Branch, total depth 1,559 feet, in Big Lime, produced 5 bbls. of oil the first day. Same operator No. 2 Jones, total depth 1,638 feet, in Big Lime, is dry hole. James Hatcher, No. 1 James Hatcher, on Mare Creek, total depth 2,979 feet, in shale, started at 1,048,000 feet of gas daily.

Martin County

Warfield Natural Gas Co. No. 4,751, Sam Maynard land, on Left Blacklog, total depth 2,681 feet, in shale, gauged 304,000 feet. The same firm completed No. 4,752, Herbert L. Delong and others land at Rockcastle at 2,671 feet, in shale, with an initial of 213,000 feet of gas.

Warfield Natural Gas Co. No. 4,748 Mable S. Agassiz, on Grassy Creek, total depth of 2,847 feet, in shale, started at 95,000 feet of gas daily and its No. 4,750 Porter on Coldwater Fork, total depth 2,649 feet in shale, produced 331,000 feet of gas initially.

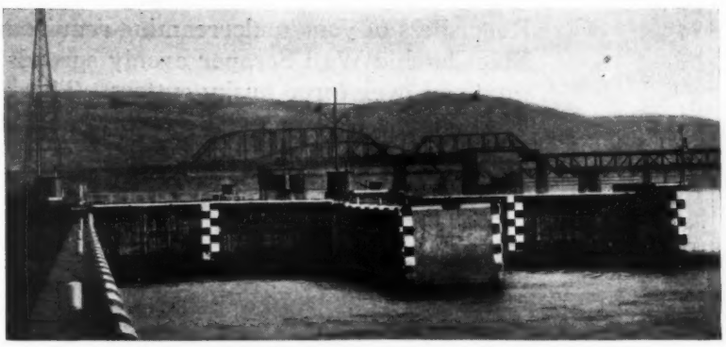
The Southeast Gas Co. No. 779 Hopson on Rockhouse Fork, total depth 2,603 feet, in shale, gauged 228,000 feet per day. The Virginian Gas & Oil Co. has a dry hole, at 1,200 feet, in No. V-1,253 Freeland Preece on Pegs Fork. Diederich & Ward No. 2 W. B. Stepp on Big Crooked Creek, total depth 1,250½ feet, in Maxton sand started at 30 bbls. of oil per day. Same operators completed No. 3 Stepp over 1,000 feet in the Maxton sand, with a daily flow of 6 bbls. of oil.

Pike County

United Carbon No. 26 on Colony C. C. & C. Co. land on Right Fork of Island Creek in Pike County,

Three Times Longer Protection

with Bakelite Resin Finish



Bakelite resin finishing system served 3 years on these gates, where others failed in 6 to 12 months.

AN exceptionally severe test of metal finishing systems is service on the Monongahela River lock gates pictured. Here, coatings must withstand, not only continuous immersion, but also high sulphuric acid and suspended-sand content in the water.

In July, 1934, an anti-corrosive finishing system based on 100% Bakelite resin was applied to these gates. Two years later, when the gates were unwatered, the Bakelite resin finish was judged fully competent to serve another full year without replacement.

This performance of Bakelite resin coating is especially impressive in comparison with other systems previously employed. Only one had stood up as long as *one* year; the others had failed in about six months. The Bakelite resin system gave three years' protection!

Similar improvements in protective value are obtained in many other systems and individual coatings, by fortifying with Bakelite resin. Leading manufacturers now supply paints, varnishes and enamels of this type for all your coating needs. Write for informative booklet 31S, "Bakelite Synthetic Resins for Paints and Varnishes."

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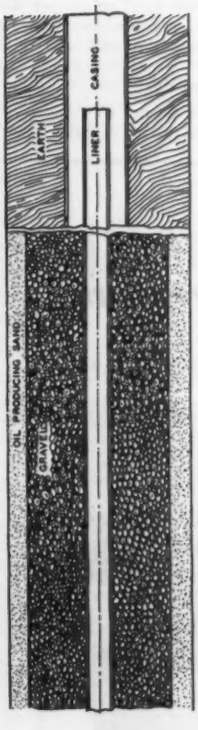
"Gravel PACKING"



ANOTHER DEFINITE PROOF OF 3 BLADE CUTTER SUPERIORITY

The superiority of the MacClatchie three blade construction has been demonstrated over a period of years on every kind of wall scraping job. The current popularity of "Gravel Packing", requiring as it does an unusual enlargement of the drill hole through the producing zone, has proved to operators that three blades are essential in a wall scraper to provide the safety which this type of work requires.

Regardless of your underreaming requirements the MacClatchie Wall Scraper evenly spreads the cutting load over three husky cutters. This exclusive MacClatchie feature is daily saving operators thousands of dollars by giving—

More full gauge hole per run because there is less load per cutter.

Smooth, easy rotation that protects your drill string from twist off strains.

Perfect cylindrical wells because there is no wobble, no vibration, and no tendency for scraper to whip.

Triple cutting action is just one of MacClatchie's engineered features. Tremendous body strength, positive cutter expansion and retraction, double action circulation and wide range scraping capacities give the MacClatchie Wall Scraper the utmost in efficiency and dependability.

The MacClatchie Giant Wall Scraper, illustrated herewith, will readily pass through 11¾" casing, but once expanded has a cutting range of 30" in diameter. Because of its wide range and smooth action it is the outstanding choice of operators for enlarging holes through the producing zone.

If you are interested in increasing production, reducing pumping trouble, speeding up cleaning out operations and decreasing well cavings, write for detailed information on the new "Gravel Bed" Method of setting liners. MacClatchie engineers will gladly furnish you valuable information on this subject.

MacCLATCHIE MFG. CO.

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total depth 3,224 feet, in shale, gauged 510,000 feet of gas per day.

Magoffin County

Operator Jenkins completed No. 1 John Adams on Short Fork at 1,168 feet, in Weir sand, a 6-bbl. well before shot.

Powell County

E. A. Wireman No. 11 Kinser Heirs No. 1, in the South Fork district of Powell County, started at 10 bbls. per day. Coleman Hall completed No. 11 S. R. Rogers nearby with daily flow of 3 bbls. of oil.

Johnson County

Francis & Webb No. 3 James Wells on Daniels Creek, in Johnson County, gauged 143,000 feet of gas per day.

Lee County

C. A. Townsend, agent, No. 9 on Andrew Combs land on Billies Fork flowed 200 bbls. of oil per day when completed.

WESTERN KENTUCKY

OWENSBORO, Ky., Nov. 8.—Completions in the western Kentucky field in the past week numbered 17, of which six were oil wells, four gas wells and seven dry holes. One of the completions started at 100 bbls. a day and another at 75 bbls., both having been shallow sand wells in the Niagara district in Henderson County. Following is the week's record of completed work, initial daily production and new operations:

Hancock County

Victoria district: J. H. Taulbee No. 2 Ed Newton, 65,000 feet of gas, 66 pounds rock pressure, Jackson sand 509-32 feet, total depth 533 feet.

Pellville district: Frank Damron and others No. 2 Marion Boling, 50,000 feet gas, Jackson sand 523-38 feet, total depth 540 feet, abandoned. Frank Damron and others No. 4 Fred Boling, 75 bbls. from Jett sand 289-335 feet, shot 80 quarts 306-34 feet, total depth 338 feet. C. D. Walker No. 2 Elmer Boling, rigging up.

Dukes school district: Galey & Fletcher No. 1 Tom Mason, dry hole, Bethel sand 532-42 feet, water at 540 feet; No. 1 Ed Hall, drilling at 20 feet.

Patesville district: Ray Cooper and others No. 2 Donnie Boling, spudding in.

Goering district: Cumberland Petroleum Co. No. 3 Tilden Brown, dry hole, Jackson sand 580-91 feet, total depth 690 feet.

Floral district: Frank Damron and others No. 3 Homer Rice, 431,000 feet of gas, 158 pounds rock pressure, Jackson sand 509-23 feet; No. 2 John Brunner, spudding in.

Ohio County

Fordsville district: Hunt & Leach No. 3 Scott Huff, moving in.

Narrows district: Porter Evans No. 1 Stanley Phillips, spudding in. Hupp and others No. 1 Annie Graham, dry hole, total depth 622 feet. No Barlow sand.

Olaton district: Cox & Lang No. 1 Ida Smith, Jett sand 260-80 feet, shot with 100 quarts, plugged.

Adaburg district: Sherman Hall No. 2 W. Whittaker, dry hole, 990 feet. B. & B. Oil Co. No. 3 Ben Midkiff, drilling at 500 feet. Jess Ellis and others No. 11 C. D. Westerfield, spudding in.

Friendship Church district: A. Teller and others No. 6 Estill Board, 10 bbls., Barlow sand; No. 7 A. H. Medcalf, 7 bbls., Barlow sand 682-94 feet, shot with 80 quarts, total depth 700 feet; No. 7 Clarence Farmer, spudding in. DeHart & Lykins No. 3 A. P. Kelly heirs, spudding in.

Taffy district: Frank Randall and others No. 10 W. C. Hoover, spudding in.

Livermore district: Clark & Snyder No. 7 Louisville Joint Stock & Land Bank, drilling at 325 feet.

Daviess County

Haynes district: Ross & Henry No. 2 Tula Lamar, spudding in. Frank Randall and others No. 1 W. L. Litsey, spudding in. Rex-Pyramid Oil Co. No. 1 Joe Brown, rigging up.

McLean County

Livermore district: W. E. Hupp No. 31 Hackett Brothers, dry and abandoned 5 feet in Mississippi lime, Bethel sand at 1,434-44 feet with a light show oil, total depth 1,455 feet. No. 32, dry and abandoned 200 feet in Mississippi lime at total depth of 1,632 feet.

(Continued on Page 260)

Southwest Texas District

OPERATIONS ARE DECLINING; GUADALUPE NEW DISCOVERY

By GEORGE WEBER

HOUSTON, Tex., Nov. 8.—Few developments of interest took place in Southwest Texas during the past week. A new sand was opened in the Seven Sisters field of northern Duval County. The Fault zone gained a new field, as a Guadalupe wildcat, which showed oil several days ago came in, and other wildcat tests throughout the area are showing indications of possible importance.

Four deep tests drilling in the Lower Coastal belt, three of them wildcats, are the center of considerable attention, with showings of oil and high pressure gas in two of them. The Clara Driscoll field of Nueces County gained new sand production, and an important outpost test is drilling northeast of the Luby field, in the same county.

Scattered wildcats throughout Southwest Texas show possibilities of new strikes. Field operations, generally declining, are mostly centered in a few areas.

The Seven Sisters field of northern Duval County came into the spotlight for the first time in several months, when a new sand was discovered. Wellington Oil Co. No. 8-D Welder, located in Survey 381, on the northwest edge of the field, cored the Cole sand as follows: 1,715-17 feet no show; 1,717-19 feet, odor of oil and gas; 1,719-1,720 feet, oil sand. On an eight minute drill stem test made at 1,714-20 feet, 1,700 feet of pipe line oil was recovered at a working pressure of 50 pounds. Seven-inch casing has been set at 1,714 feet and operators will attempt completion of the well this week.

This is the most shallow sand to show production in the Seven Sisters field. Four sands are now productive in the field proper, the Chernosky, two Government Wells sands, and the Loma Novia sand, and a large number of wells have been drilled to each of the sands in the respective sections of the field where they are productive. The discovery of the Cole sand production on the northwest edge of the field may lead to further development of an area which has been quiet for the past several months.

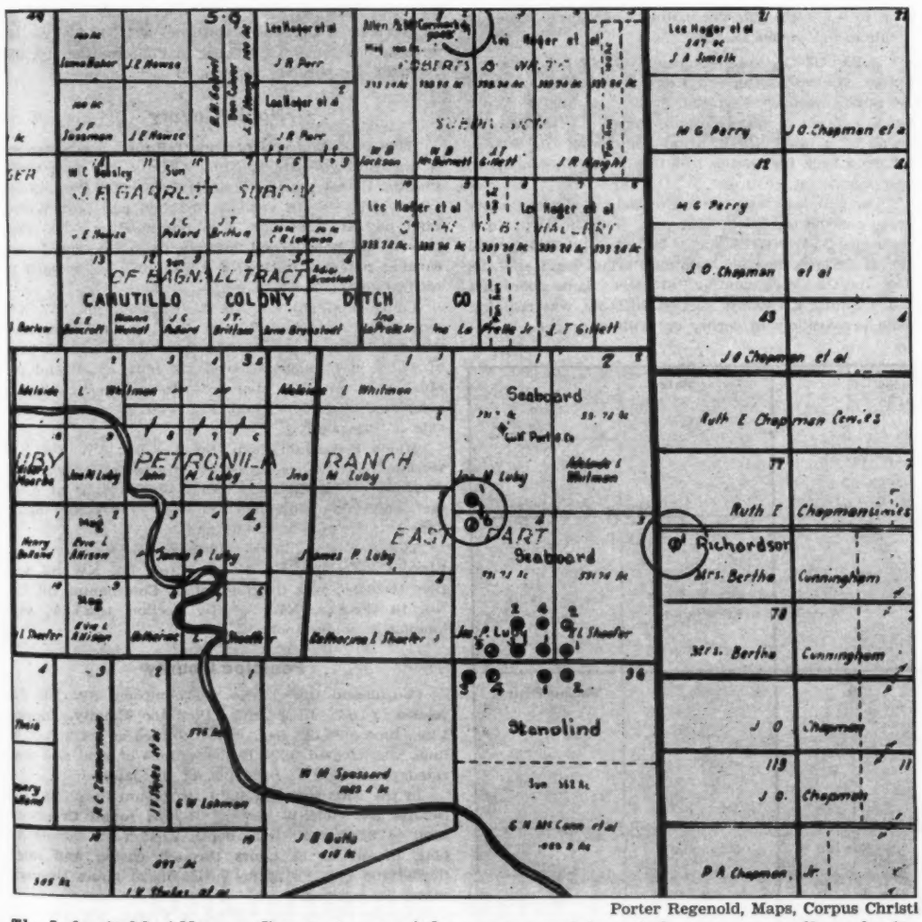
Outside of the Benavides, Oilton and Killam fields, the Laredo District is unusually quiet. At Benavides, or North Sweden, edge tests are attracting attention. In the eastern section of the field, offsetting Woodley Petroleum Co. No. 1 Puig on the south, Benedum-Trees Inc. No. 8 Puig is attempting completion. The test made oil at the rate of 144 bbls. per day and then stopped flowing, and operators have pulled tubing to rework. A west extension brought in several weeks ago, Blanchard's No. 1 Puig in section 8 of the Sweden Farms Lots, stopped flowing recently, and is being swabbed. Four oil wells were completed in the field proper this week, in the regular field sand at 4,800 feet. A fifth test, Russ Petroleum Co. No. 2 Rossi, on the southwest edge of the field, was carried to a total depth of 5,370 feet. A test on the deeper sand at 5,358-60 feet showed only oil cut mud and the test was plugged back to the regular, or Gravis sand to complete as a gasser.

Due to the shallow depth of production, and the ease of drilling, the completions run high in the Oilton field of southeastern Webb County. This week six oil wells were brought in, and one gas well completed. Most of the wells are brought in on the pump.

Deep wildcats in the Lower Rio Grande Valley attracted attention with showings of production and threatened blowouts. In Hidalgo County the Atlantic Refining Co. cored a gas sand at 8,025-60 feet in No. 1 American Rio Grande. The test tried to blow out, but the crew killed it, and are coring ahead. The wildcat is located in the eastern section of the county in the little explored area 3 miles southwest of the town of Weslaco.

To the north and east in Willacy County, Magnolia Petroleum Co. cored a reported oil sand at 5,586-5,600 feet and is drilling below 5,750 feet. Across the county line in Kenedy County, located north of the La Sal Vieja field, La Sal Vieja Oil Corp. is drilling below 4,250 feet on No. 1 Garcia, an interesting wildcat.

The La Blanca field of Hidalgo County gained another producer when Dee Davenport's No. 1 Hidalgo Water Improvement District was brought in through perforations at 7,906-16 feet for a small producer making 120 bbls. per day.



Porter Regenold, Maps, Corpus Christi

The Luby field of Nueces County is one of the most promising of the recent small pools discovered in that area. In the past two weeks, a mile northwest extension has been made to production by Seaboard Oil Corp. No. 1 John M. Luby, and a new sand has been brought into production on the southwest edge by Stanolind Oil & Gas Co. No. 3 McCann. The regular field sand is at 5,050 feet and the new Stanolind sand is producing at 4,350 feet

Corpus Christi Area

The principal development in the Corpus Christi District, or Lower Gulf Coast section, was the opening of a new sand to production in the Clara Driscoll field of western Nueces County. Making 151 bbls. per day of 31.5 gravity oil, the O. W. Killam No. 5 Elick added another producing sand to the field at 4,642-51 feet.

At the same time, the South Clara Driscoll field was extended slightly to the northwest by completion of the Sun Oil Co. No. 1 Flynn, which made an initial production of 216 bbls. per day of fluid consisting of 15 per cent salt water.

The Luby field of the same county, one of the most promising of the newer pools in the area, gained a good producer in Seaboard Oil Corp. No. 4 Luby. The field was extended a mile to the north last week, and a new sand was opened to production at the same time on the southwest edge. Operators are currently watching a wildcat, Richardson Petroleum Co. No. 1 Cunningham. The test is drilling below 3,500 feet 5,800 feet northeast of the Seaboard Oil Corp. No. 1 Shaefer, which marks the present eastern limit to the field.

Saxet Activity Declining

Saxet, still the most active field in the Lower Gulf Coast, has declined considerably in the past few weeks in actual drilling activity. The deepest test to have been drilled in the field, Texon Drilling Co. No. 5 Vance was carried to a total depth of 8,229 feet this week. Operators are plugging back to the 6,900-foot sand, deepest producing horizon in the field, to test it.

Possibility of a new Nueces County field is seen in

(Continued on Page 264)

Oklahoma Operations

By
DAL DALRYMPLE

NEW POOL FOR CALVIN AREA; HUGHES COUNTY'S PROSPECT

The opening of a new oil pool south of Calvin in Hughes County, Oklahoma, appeared imminent as the Phillips Petroleum Co. No. 1 Becker, wildcat, NE NW SW section 8-5-10, looked like a certain producer. It topped Cromwell sand at 4,398 feet and a core from 4,429 feet to 4,436 feet yielded 1 foot of saturated sand. When the core was taken, gas flow increased from about 19,000,000 feet to 21,200,000 feet and production of oil amounted to 10 bbls. in 12 hours. Operators were to core ahead.

Extension of the Wellston pool of Lincoln County one-fourth mile westward was indicated at Skelly Oil Co. No. 1 Erwin, NE SW SW section 35-15-2e. It found Wilcox sand at 4,476 feet and at 4,501 feet, total depth, had 450 feet of oil in the hole. It was to be cleaned out and shot.

A big producer in the Traugh pool of southern Seminole County was near completion at Atlantic Refining Co. No. 1 Dameron, NE NE NW section 22-6-6, a south offset of the Wilcox sand discovery well in the pool. It had Simpson Dolomite at 3,580-83 feet, total depth, and with the Wilcox formation yet to be penetrated it was showing large production. In one six-hour test it flowed 978 bbls. of oil, and in a three and one-half hour test it flowed 560 bbls. of oil, filled tankage on the lease and was shut in. In the last hour of the test it flowed 165 bbls. Separator and connections were being installed.

The outlook for the Moore field of Cleveland County was improved as a result of revisions made in proration rules there and because of the favorable showing in an east edge well. Average gas-oil ratio was reduced from 4,797 to 4,065 cubic feet of gas to the barrel of oil during October, resulting in a saving of 226,000,000 feet of gas during the month, according to state conservation reports. The average reservoir pressure was off only 52 pounds, declining from 1,178 to 1,126 pounds, compared with a drop of 91 pounds the previous month. Salt water intrusion declined considerably, according to engineers, only a few wells now having that trouble. The adjusted potential for the field, based on pressures and ratios, for November is 445,201 bbls., as against 459,453 bbls. in October.

Outpost at Moore

On the extreme east side of the field, Fain Drilling Co. and others No. 1 Greenlee, SW SW NW section 22-10-2w, was checking higher geologically than the field average. It had Oswego lime at 6,440 feet, some 19 feet higher than the well which was highest in the field on Wilcox pay. The Greenlee well was drilling below 6,680 feet, and one-half mile east of it Sinclair Prairie Oil Co. and others No. 1 Gross, SW SW NE section 22-10-2w, has spudded to 960 feet and was preparing to set surface pipe. Royalty play in the area is reported to have been revived as a result of drilling of these two wells. The only other active well in the field is Gulf Oil Corp. No. 4 James, SW NW SW section 27-10-2w, making hole below 5,300 feet.

Hollenback and others No. 1 Mattie Clark, NW NW NW section 34-21-6w, wildcat in Garfield County, was drilling ahead below 4,470 feet, in shale and lime.

Carter Oil Co. and others No. 1 Claytor, CWL NE SW section 27-2n-9, wildcat in the Centrahoma area, Coal County, failed to get a recovery in core from 6,352 feet to 6,355 feet and was bailing down, preparatory to drilling and coring ahead.

Coline Oil Co. No. 1 Johnson, SW SE NE section 1-2n-8w, wildcat in Stephens County, swabbed to bottom of tubing, recovered most of an oil load and showed a small amount of gas. Operators were to splice line and swab at a lower level. Total depth was 10,000 feet, plugged back for testing to 9,106 feet. Seven-inch casing was set at 8,970 feet.

The two deep tests in the Fox field of Carter County were nearing the oolitic lime pay. Gulf Oil Corp. No. 1 Johnson, C SW NW section 27-2s-3w, was drilling ahead below 7,823 feet, after topping Burgen sand at 7,798 feet and Oil Creek sand at 7,815 feet. Same operator's No. 1 Smith, C SW SW section 26-2s-3w, was reaming hole preparatory to coring or drilling deeper. It has been cored from 7,364 feet to 7,380 feet, recovering brown, sandy Dolomite, with some shale streaks and slight saturation.

Wildcat Completions

Wildcat completions of the week offered little to enthuse over. Gulf Oil Corp. No. 1 Prichard, SE NW SE section 32-3s-16w, wildcat in southern Tillman County, topped Simpson series at 5,165 feet, Dolomite 5,467 feet, and was dry and abandoned at 5,715 feet, total depth, in top of Arbuckle lime.

Boettcher Oil & Gas Co. No. 1 Gann, SE NW NE section 25-4n-7, Pontotoc County wildcat, topped Hunton lime at 3,879 feet, Sylvan shale 4,100 feet, Viola lime 4,213 feet, had a fishing job at 4,347 feet, total depth, and was abandoned.

F. W. Merrick No. 1 Mackey, NE NE SW section 29-11-10, wildcat south of Okemah in Okfuskee County, found first Wilcox sand at 4,015 feet, second sand at 4,052 feet, had a hole full of water at 4,060 feet and was dry and abandoned at 4,062 feet, total depth.

Lesh Brothers No. 1 Carson, SW SW SE section 18-3s-2w, wildcat south of the Graham area in Carter County, was abandoned when water intruded at 320-340 feet, total depth.

Norbla Oil Co. No. 1 McBride, NE NE SW section 10-2n-5, location for a wildcat in Pontotoc County, was reported temporarily abandoned.

Noble County

Two oil producers and one failure were registered in the Billings district, Noble County, the past week. Phillips Petroleum Co. & Shell Petroleum Corp. No. 6 O'Neil, NE SW SE section 16-23-2w, had best Wilcox sand pay at 4,264 feet, was bottomed at 4,305 feet, flowed 930 bbls. of oil in 6 hours on potential test, earning potential rating of 3,658 bbls. Gas gauged 2,700,000 feet.

Continental Oil Co. No. 11 Conway, SE NW NW section 21-23-2w, had Wilcox sand at 4,306 feet, total depth 4,316 feet, flowed 314 bbls. of oil and 64 bbls. of water in 12 hours, flowed 174 bbls. of oil and 161 bbls. of water in 6 hours of potential test, and was completed as a 75-bbl. minimum well. It is on the west side of the pool.

Midco Petroleum Corp. No. 1 Kern, NW SW NW section 27-23-2w, southeast of the main Wilcox production area at Billings, found Wilcox sand at 4,541 feet, salt water intruded and it was dry and abandoned at 4,629 feet, total depth.

Two new tests in the Billings area were reported. Lincoln Petroleum Co. No. 4 O'Neil, NE NW SE section 16-23-2w, was digging cellar. Continental Oil Co. No. 13 Conway, NW SE SW section 16-23-2w, was moving in rotary tools.

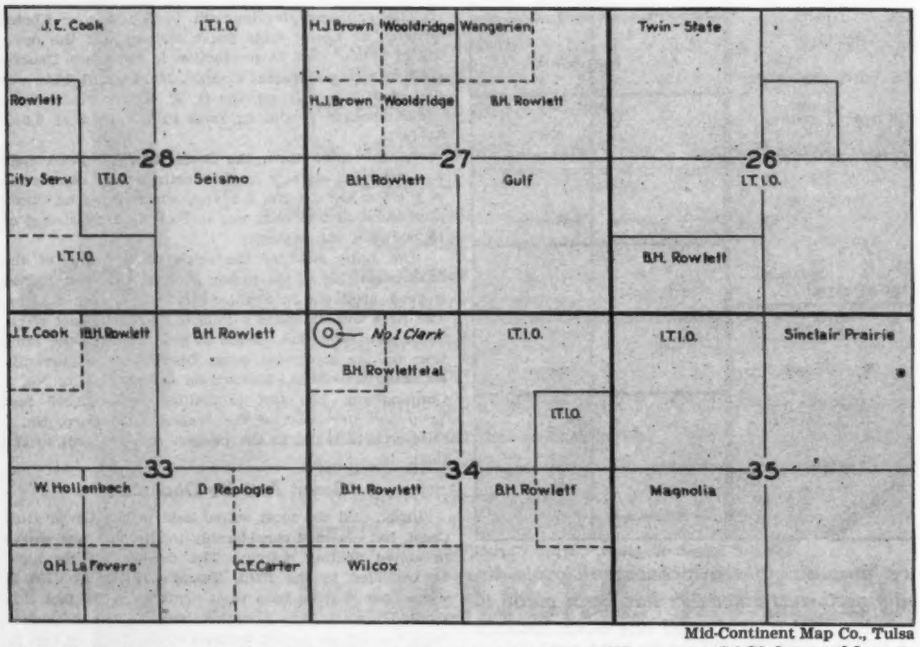
Pontotoc County

Continental Oil Co. No. 2 Thompson, SW NE SE section 2-1n-7, Jesse area, Pontotoc County, topped Viola lime at 4,188 feet, was bottomed at 4,422 feet in lime, was treated with 10,000 gallons of acid and was rated potentially at 612 bbls. of oil daily.

In the Fitts district, Stahl Petroleum Corp. No. 3-C Dennis, SW SE SW section 21-2n-7, found Cromwell sand at 2,593 feet, total depth 2,645 feet, flowed 45 bbls. of oil in 12 hours through casing and later flowed 100 bbls. of oil by heads in 24 hours through tubing, completed.

Sinclair Prairie Oil Co. No. 4 Vivian, NE SW NW section 22-2n-7, topped Hunton lime at 3,793 feet, total depth 3,805 feet, flowed 105 bbls. of oil in 4 hours through tubing, was acidized, flowed 29 bbls. of oil in 2 hours through tubing and was completed as a minimum well.

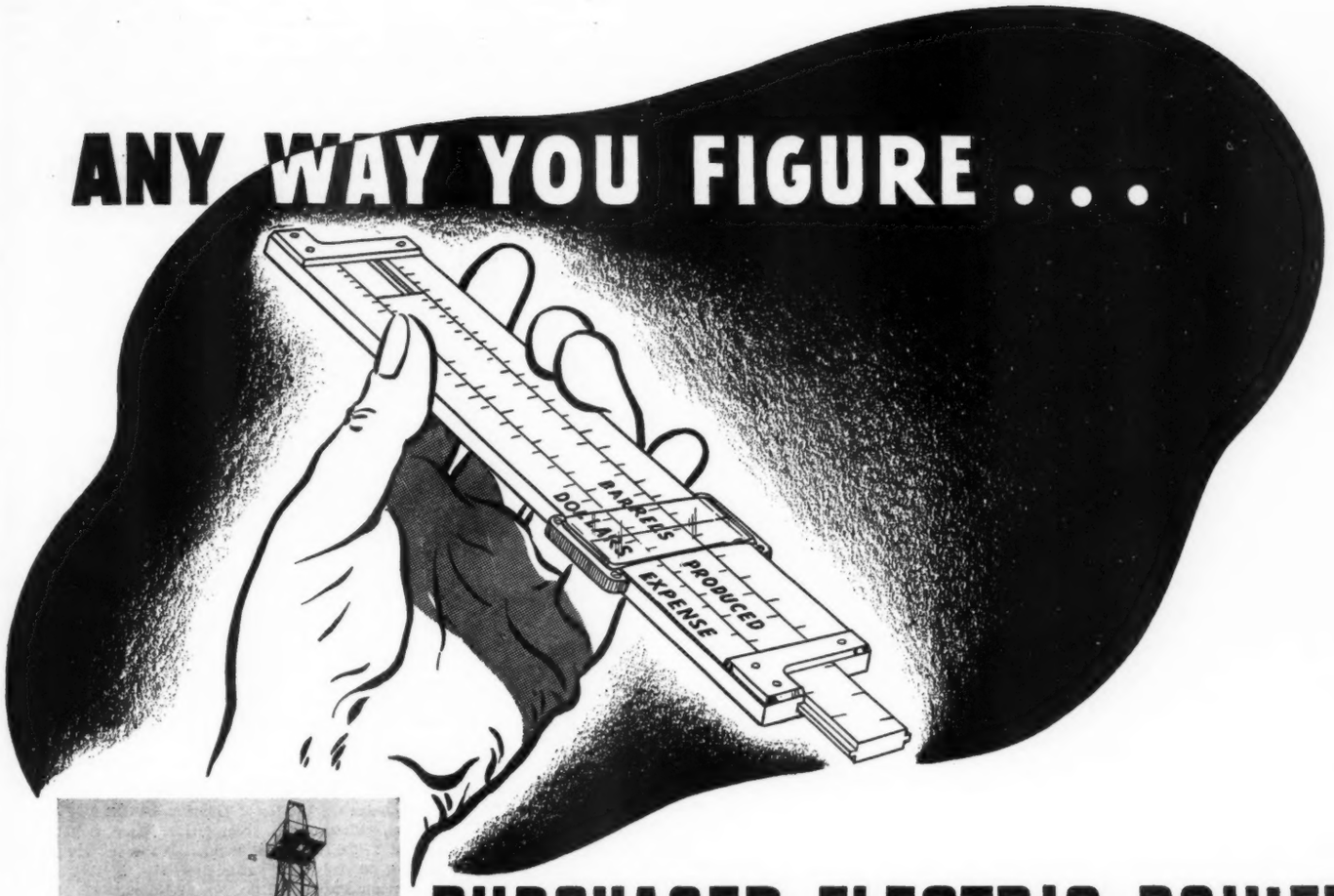
Phillips Petroleum Co. No. 1 Leedy, NE cor. sec-

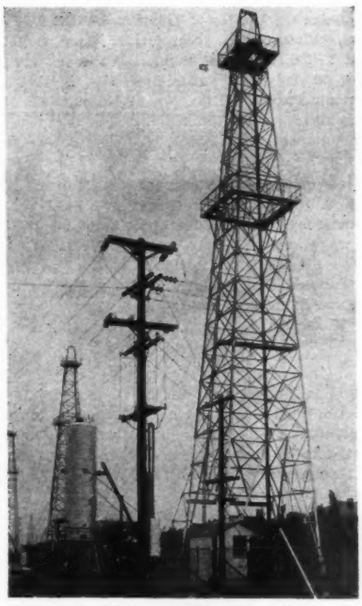


Mid-Continent Map Co., Tulsa

H. R. Hollenback and others No. 1 Mattie Clark, NW NW NW section 34-21-6w, wildcat in Garfield County (shown on map as B. H. Rowlett et al), was drilling below 4,470 feet

ANY WAY YOU FIGURE . . .





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tion 22-2n-7, had Hunton lime at 3,968 feet, total depth 3,996 feet, and flowed 291 bbls. of oil and 96 bbls. of water, with 31 bbls. of basic sediment in 24 hours on gas lift. It was treated with 6,000 gallons of acid and potential was estimated at 341 bbls. of oil.

R. W. Simpson & Crusaders Petroleum, Inc. No. 2-B Woolley, NE NW SE section 28-2n-7, flowed and swabbed 100 bbls. of oil through casing in 24 hours from Cromwell sand topped at 2,398 feet, and was completed at 2,504 feet, total depth.

E. H. Moore No. 5 Harper, SW NW NE section 29-2-7, an old well, was plugged back from 3,750 feet to 2,815 feet, shot, pumped 63 bbls. of oil in 24 hours and was recompleted.

Same operator's No. 1-B Schauers, NW SW NW section 29-2-7, an old well, was plugged back from 3,655 feet to 2,702 feet, shot and was recompleted, pumping 85 bbls. of oil in 24 hours.

The following locations were reported temporarily abandoned: E. H. Moore No. 1-A McCoy, NE SE SE section 29-2n-7; same operator's No. 7-A Woodruff, SW NE SE section 29-2-7; same operator's No. 8-A Woodruff, SE NW SE section 29-2n-7, and same operator's No. 3 Thompson, SW SE SE section 33-2n-7.

New work in Pontotoc County: Continental Oil Co. No. 4 Thompson, C E½ NW SW section 1-1n-7, location; same company's No. 3 Thompson, C E½ SW NE section 2-1n-7, cellar; Superior Oil Co. & Crusaders Petroleum, Inc. No. 1 Brydia, SE SW SE section 24-2n-6, drilling at 1,847 feet; Crusaders Petroleum, Inc. No. 8 Morin, NW SW SE section 20-2n-7, rigging up rotary; Harper Turner No. 1 Malloy, SW NE SW section 20-2n-4e, drilling at 140 feet; Frank Newsom and others No. 3 Walker, SW NW SW section 11-4n-6, moving in machine; Barbara Oil Co. No. 2 Mount, NW NE NW section 36-5n-6, cellar and pits; W. A. Delaney No. 1 Wheeler, SW NW SW section 30-5-8, location.

Logan County

Champlin Refining Co. No. 5 Pfeiffer, NE NW NW section 4-19-2w, Lucien field, Logan County, found second Wilcox sand at 4,884 feet, was bottomed at 5,043 feet, flowed 2,174 bbls. of oil in 24 hours, later flowed 2,100 bbls. in 10 hours through casing and made potential of 4,538 bbls., with 12,000,000 feet of gas.

Seminole County

Sun Oil Co. No. 1 Letka, SE NW SW section 35-11-5, North Earlsboro pool, Seminole County, topped Wilcox sand at 4,590 feet, total depth 4,602 feet in sand, swabbed 155 bbls. of oil in 20 hours and was completed.

Wood Oil Co. No. 1 Fleet, SW SE NW section 12-5-7, had first Wilcox sand at 4,212 feet, second sand 4,325 feet, total depth 4,333 feet with water showing, plugged back to 4,317 feet, acidized and perforated casing without results and was dry and abandoned.

Devonian Oil Co. No. 1 Whitworth, SE SW NW section 27-7-7, was dry and abandoned at 2,675 feet, total depth.

New activity in Seminole County: W. C. McBride, Inc. No. 1 Jackson, NE NE SW section 16-6-7, wildcat, location; Manahan & Moore No. 4 Williams, NW SW NE section 22-6-6, location; same operators' No. 3 Williams, SW SW NE section 22-6-6, rigging up rotary; Amerada Petroleum Corp. and others No. 6 Parks, SW NE SW section 35-11-5, location; same operators' No. 2 McGill, NE SW SW section 35-11-5, moving in tools.

Pottawatomie County

Magnolia Petroleum Co. No. 3 Green, NW SW NW section 13-7-4, St. Louis district, Pottawatomie County, had Calvin sand at 3,138 feet, total depth 3,147 feet, flowed 484 bbls. of oil through casing in 24 hours, later flowed 503 bbls. in 24 hours and was completed.

E. W. Jones and others No. 1 Hendrick, NW NE NW section 5-8-3e, was bottomed at 5,278 feet, plugged back when water intruded, but was dry and abandoned.

Magnolia Petroleum Co. No. 4 Caudle, NW NW SW section 13-7-4, was building rig. Exchange Drilling Co. No. 1-A Risenhoover, SW SE NE section 14-7-4, was drilling at 1,065 feet.

Hughes County

Amerada Petroleum Corp. and associates No. 4 Stewart, NW NW SW section 31-9-9, Hughes County, had Misener sand at 4,024 feet, total depth 4,031 feet in sand, flowed 302 bbls. of oil through casing in 24 hours and was completed.

McGee No. 5 Taylor, SW NW NW section 12-9-10, was rigging up machine.

McGee No. 3 Taylor, SW NW NW section 12-9-10, topped sand at 1,167 feet and was dry and abandoned at 1,186 feet, total depth.

Same operator's No. 4 Taylor, SW NW NW section 12-9-10, had a hole full of water and was dry and abandoned at 562 feet, total depth.

Estimated Daily Production

Estimated daily average production of Oklahoma for the week ending November 6 and for the preceding week was as follows:

	Barrels	
	Nov. 6	Oct. 30
Allen	5,500	5,525
Billings	7,900	7,875
Burbank	7,900	7,900
South Burbank	14,250	13,500
Balance Osage	20,500	20,250
Blackwell district	5,050	5,000
Bristow-Slick	7,225	7,200
Chandler	2,850	2,875
Crescent	7,825	8,425
Cromwell	3,450	3,450
Cushing-Shamrock	11,100	11,150
Duncan district	3,950	3,975
Edmond	12,000	12,400
Fish	5,350	5,425
Fitts	69,650	79,250
Jesse	2,875	3,350
Graham	4,400	4,475
Gray	1,325	1,175
Healdton	10,150	10,050
Hewitt	4,325	4,350
Holdenville	875	850
Keokuk	7,600	8,300
Konawa	1,550	1,525
Lucien	15,500	14,150
Moore	9,575	9,800
Oklahoma City	147,325	141,150
Olympic	9,600	9,675
Polo	900	875
Sasakwa and townsite	2,525	2,525
Sholem-Alechem	3,050	3,000
Seminole:		
Bowlegs	11,400	11,350
Carr City	5,075	5,050
Earlsboro	6,100	6,050
South Earlsboro	675	675
East Earlsboro	7,200	7,225
Little River	9,400	9,525
East Little River	1,125	1,100
Maud	700	700
Mission	1,925	1,925
Seminole	9,400	9,575
East Seminole	2,125	2,200
Searight	4,175	4,375
Total Seminole	59,300	59,750
St. Louis-Pearson	19,675	19,550
Tatums	5,950	6,075
Tonkawa-Garber-Thomas	4,400	4,450
Wewoka	2,800	2,775
Yale-Jennings	4,200	4,175
Other pools	79,975	80,500
Total Oklahoma	582,375	586,725

Cleveland County

Sinclair Prairie Oil Co. and others No. 3 Rice A, SW NE NE section 28-10-2w, Moore field, Cleveland County, found second Wilcox sand at 7,266 feet, was bottomed at 7,294 feet, salt water intruded and it was plugged back to 7,285 feet. It flowed 230 bbls. of oil with no water in 24 hours, through tubing, and was completed.

Garvin County

Skelly Oil Co. No. 4 Gross, SW NE SW section 32-1n-3w, Tussy pool, Garvin County, swabbed 60 bbls. of oil in the first 4 hours, pumped 249 bbls. in 24 hours and was completed at 2,905 feet, total depth, in broken sand and shale. It had a series of sands beginning at 2,541 feet.

Patsy Oil Co. No. 2 Derdeyn, SW SE SE section 17-1n-3w, Robberson area, was bottomed at 3,803 feet, plugged back to 1,800 feet, perforated casing and pumped 22 bbls. of oil and 15 bbls. of water in 24 hours. It had sand at 1,625-52 feet and sandy lime at 1,735-50 feet.

Okmulgee County

W. O. Shock No. 8 Fields, C NE NW section 16-14-11, Okmulgee County, had Dutcher sand at 2,388 feet, total depth 2,418 feet, and flowed 275 bbls. of oil in 24 hours, with an estimated 2,000,000 feet of gas.

Allen and others No. 1 Chambers, SW NE NE section 25-16-11, pumped 10 bbls. of oil daily from Bartlesville sand at 1,695 feet, total depth 1,761 feet.

R. F. Harmon No. 7 Newhouse, SE NE NW section 20-12-12, was completed as an 8-bbl. pumper in sand at 1,892-1,905 feet, total depth.

Acme Supply Co. & H. C. Detrick No. 1-B Chapman, NE SW SW section 20-14-11, was dry and abandoned at 2,492 feet, total depth.

Osage County

Indian Territory Illuminating Oil Co. No. 447 Osage, SE NE NE section 16-26-12, was the only Osage County completion of the week. It was bottomed at 1,770 feet, plugged back to 1,535 feet, perforated casing, shot and acidized and produced 4,500,000 feet of gas. Top of Mississippi lime was 1,510 feet.

New work in Osage County: Oklahoma Natural Gas Co. No. 1,940 Osage, NE NE SE section 18-20-12, location; E. O. Platter No. 8 Osage, SE SE NW section 13-21-8, drilling at 280 feet; Peters Petroleum Corp. & Sinclair Prairie Oil Co. No. 20 Osage, SW NW NE section 24-24-7, location; Indian Territory Illuminating Oil Co. No. 7 Osage, C E½ W½ SW section 13-24-9, an old well, plugged back from 2,107 feet and will test Peru sand at 1,550-80 feet; Wolverine Oil Corp. No. 13 North Avant Unit, NW NW SW section 32-24-12, location; same company's No. 14 North Avant Unit, SE NW NW SW section 32-24-12, location; same company's No. 56 North Avant Unit, CEL W½ NE section 31-24-12, location.

Tulsa County

Wright & Kunkle No. 7-A Billingsley, NE NE SE section 24-17-14, Tulsa County, had sand at 1,582-90 feet, total depth 1,645 feet, and was completed as a 3-bbl. pumper.

Muskogee County

P. Atkins No. 1 Anicker, NE SE SE section 14-14-16, had sand at 650 feet, total depth 665 feet, and produced 1,000,000 feet of gas, completed.

Browning & Potter No. 1-A McCarty, NW SE NE section 33-15-16, had a hole ful of water and was abandoned at 1,792 feet, total depth.

Okfuskee County

C. G. Thornton No. 1 Fixico, NE SE SW section 25-10-10, Okfuskee County, topped first Gilcrease sand at 2,595 feet, second Gilcrease sand 2,722 feet, total depth 2,740 feet, and produced 5,000,000 feet of gas daily.

Hayes & Scruggs No. 1 Barnett, NW NW SE section 21-10-11, had Gilcrease sand at 2,433-2,540 feet, total depth, was acidized, and produced 3 bbls. of oil and 2,000,000 feet of gas daily.

Carter County

Samedan Oil Co. No. 2 Thomas, SW SE NW section 7-2s-2w, Wildcat Jim area, Carter County, had first pay at 2,402 feet, total depth 2,615 feet, pumped 57 bbls. of oil daily and was completed.

Sinclair Prairie Oil Co. No. 14 Holman, SE NE NW section 16-4s-3w, Healdton field, was completed as a 22-bbl. pumper in sand at 1,254 feet, total depth 1,268 feet.

Three new operations in Carter County were reported. E. M. Bering and others No. 1 Sullivan, SE SE SW section 6-5s-1e, wildcat northwest of the Brock pool, was rigging up tools. K. O. T. Oil Co. No. 2 Ramsey, SE SE NW section 36-4s-2w, an old well, was bottomed at 2,366 feet and rigging up machine to deepen. Same company's No. 6 Westheimer B, NE NW NW section 36-4s-2w, was a derrick.

Caddo County

Magnolia Petroleum Co. No. 7 Medrano, NW NW SW section 36-6-10w, Cement field, Caddo County, had sand at 4,638 feet, total depth 4,662 feet, flowed 225 bbls. of oil the first 24 hours, later flowed 140 bbls. of oil through tubing in 24 hours, with 16,000,000 feet of gas, and was completed.

Ohio Oil Co. No. 5 Bruce, NW SW NE section 11-5-9w, had dug cellar and pits.

Stephens County

Carter & Ring No. 14 Arm, NW NW NE section 26-1s-5w, the only Stephens County completion, had sand at 390-410 feet, total depth, and pumped 2½ bbls. of oil daily.

Other First Reports

In Oklahoma County, Travis Petroleum Co. No. 1 Jordan Place, NE cor. section 35-12-3w, was bottomed at 1,095 feet and reaming to run 12½-inch casing. Big Chief Drilling Co. No. 2 Park Place, NE SE NE section 35-12-3w, was a rig.

In Grant County, Carter Oil Co. and others No. 1 Barclay, C E½ SE NE section 17-25-3w, was a rig.

In Kay County, Wentz Oil Corp. No. 4 Andrews, SW SW NE section 8-28-1w, set 13-inch casing at 93 feet. E. J. Shaffer and others No. 2 Haunchild, C S½ SE NW section 8-28-1w, was digging cellar.

In Lincoln County, Buell & Herndon No. 1 Thomas, C SW SW section 10-13-6, was a rig.

In Choctaw County, J. A. True No. 1 Boby, SE NW NW section 17-7s-19e, wildcat, was a location.

In Coal County, Continental Oil Co. No. 2 King, SW SE NE section 26-1n-8, was a cellar.

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Among Gulf Coast Drilling Contractors

Thompson Drilling Co. has apparently opened prolific production in the Old Orange field in Orange County with the drilling of Tillery & Ryan No. 1 Chesson, located 1¼ miles west of production, which picked up a saturated sand section around 5,900 feet, and while making a drill-stem test flowed pipe line oil. Casing has been cemented and it is to be given a production test this week. It opens a new sand for this old field which heretofore has produced only from the Miocene at shallow depths. A good producer here is expected to create an active drilling campaign due to the division of ownership which is held by several major and independent companies.

W. V. Bowles has moved one of his rotaries to Victoria County for a wildcat which will be drilled for himself on the Robertson lease in the Thomas G. Burnham Survey. Two of his outfits are operating in the Hull field, Liberty County, for the Texas Co.

George Echols has moved in for another test on the W. H. Bennett lease in the north extension area of the Heyser field in Victoria County for Sinclair Prairie Oil Co. He has one moving in for himself to the same portion of the field, while another is on location north of the town of La Ward for Cockburn and others on the Mike Strauss lease.

Rutherford Drilling Co. received contract from Superior Oil Co. for an interesting wildcat to be drilled on the Riveria Beach Prospect in Kleberg County which is scheduled to be drilled to approximately 6,500 feet. Another rotary is being moved to the Taft field for a joint test with Tide Water Associated Oil Co. Active operations include United North & South Development Co. No. 1 Lambert, which has reached a depth of 9,721 feet, and Skelly Oil Co. No. 4-B Cobb at Van Vleck, which is coring below 8,765 feet. The latter is a projected deep test and is scheduled to be drilled below 10,000 feet.

Housh, Schofield and Thompson, who have kept several rigs running in the Talco field, have moved one of their outfits to Hardin County, where they are rigging up John Mayo and others No. 1 Hayden.

Nicklos Drilling Co. received contract for another test at the Valentine field from the Pan American Production Co. Derrick is being built and the rig will be moved in as soon as the company's No. 10 Harang is completed. No. 12 and 13 Harang are drilling below 6,400 and 1,800 feet, respectively, while for the Continental Oil Co., in Jefferson Davis Parish, No. 1 Faye is drilling below 6,700 feet. One rotary is being used on workover work in the Tepetate field for the same company while another is on location at the Villa Platte field, awaiting development plans.

Tippett Drilling Co. of Shreveport has moved a large rotary to the active Hardin field, Liberty County, where it has spudded Jameson & Byron No. 1 Hinson.

Glenn H. McCarthy received contract from the Texas Co. for No. 2 Pansy Yount, an outpost test to the West Beaumont field in Jefferson County. He has completed his No. 6-A Longe for an initial production of 232 bbls. per day through a quarter-inch choke. North of the Nome field in Jefferson County, Lee Brothers semi-wildcat test has been spudded. No. 2-A Foley in the Palacios field, which was drilled for Atlantic Refining Co., has been abandoned, while Sun Oil Co. No. 1 Bayshore Farms continues drilling below 11,000 feet.

Loffland Brothers have opened the first commercial oil production at the Abbeville field in Vermilion Parish, Coastal Louisiana, by the completion of Continental Oil Co. No. 1 Brookshire. The well is located a quarter of a mile east of the discovery well and was completed through perforated casing at 7,884-90 feet for an initial production of 360 bbls. per day through a three-sixteenths inch choke with tubing pressure 1,800 pounds and casing pressure 2,500 pounds. In the South Jennings field Loffland Brothers No. 1 Fontenot is coring below 9,000 feet after coring sand with good oil and gas showings in the discovery horizon.

H. J. DeArman marked up another producer for himself in the Sandy Point field, Brazoria County, with the completion of his No. 3 Fite, which was completed through perforations at 6,483-96 feet. First production tests on his No. 1 Edmundson, a possible 6,000-foot west extension to the field, showed salt water and it is plugging back to a higher level. Stanolind Oil & Gas Co. No. 2 Fite is bottomed at 6,498 feet with 5½-inch casing cemented at 6,492 feet.

Jack Frazier is moving in a rig for his No. 2 Lynott and Buffam in the Hardin field, and received contract from Strake Petroleum Co. for a second well to be drilled in the south extension area which was completed by Frazier two weeks ago.

Of the 30 locations reported for the Texas Coast the past week, four were wildcats. In Galveston County, Sun Oil Co. staked No. 1 Cade in the A. Dickinson Survey. In Hardin County, John Mayo has derrick up for No. 1 Hayden. Southwest of the Mauritz field, Jackson County, Sam G. Harrison has derrick up for No. 1 Meyers in the O. York Survey, while north of Eagle Lake in Colorado County O. C. Garvey No. 1 Buback-Ernest is located in the M. Lapham Survey.

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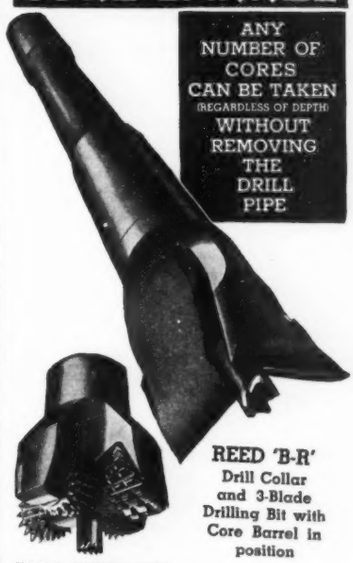

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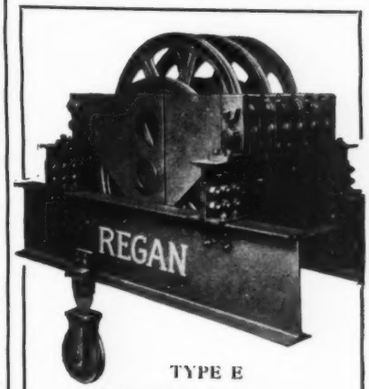

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Eastern Field Report

By STAFF CORRESPONDENT

DEEP GAS TEST IN JACKSON COUNTY, W. VA., A FAILURE

PITTSBURGH, Pa., Nov. 8.—The test of the United Carbon Co. on the Elizabeth Ward Perkins farm in Washington district, Jackson County, West Virginia, proved a failure. It was the first deep test in the district and topped the Oriskany sand at 5,440 feet (corrected measurement) and at 5,444 feet salt water intruded, which rose 300 feet in the hole. At 5,447 feet there was 600 feet of water in the hole and at 5,449 feet the water rose to 3,500 feet. Drilling was continued to 5,462 feet, where the formation changed back to lime (Helderberg). The test will be plugged. Another test on this farm is drilling up a bailer, lost near the bottom of the hole at 5,000 feet.

SOUTHEAST OHIO

The deep test of the Natural Gas Co. of West Virginia on the D. DeSellem farm in section 26, Wayne Township, Columbiana County, Southeast Ohio, topped the Clinton sand at 6,303 feet and is drilling at 6,325 feet in a very hard formation. This is the first test to that depth in the county.

The best test for the week was in Knox County, where the Preston Oil Co. completed a well on the Helena D. Faster farm in the SW quarter of section 4, Union Township. It was drilled in the Clinton sand at 2,865 feet and produced 130 bbls. the first day after shot.

In Athens County, A. D. Townsend, on the W. S. Kelley farm near Guysville in section 11, Lodi Township, drilled through the Second Berea sand to 1,785 feet and it was dry. In the central part of section 13, Ames Township, Carpenter & Glazier No. 19 John Smith was dry in Cow Run sand and was abandoned at 245 feet.

In Coshocton County, Pure Oil Co. No. 4 Harry Carpenter, in Clarke Township, is a 3- to 5-bbl. well in Clinton sand at 3,420 feet.

In Licking County, North Fork Oil Co. completed No. 11 John C. Williams in section 4, Hanover Township, in Berea sand at 656 feet. It is showing for a 4-bbl. pumper. In section 6, Perry Township, Striker & Armbuster completed No. 10 G. E. Patton in Berea sand at 668 feet and it is good for 6 bbls. a day, after a shot.

In Lorain County, Ohio Fuel Gas Co. completed a dry hole on the N. Ohmes farm, Lot 81, Columbia Township, in the Clinton sand at a depth of 2,705 feet.

In Medina County, Ohio Fuel Gas Co. completed a test on the B. Nichols farm in section 37, Medina Township, in the Clinton sand at 3,484 feet. It is a gas well gauging 225,000 feet a day. In Homer Township, Tract 14, Lot 1, E. R. Edson & Son Co. completed a second test on the C. L. Billman farm in Clinton sand at 2,804 feet. It is a gas well gauging 200,000 feet a day.

In Muskingum County, H. W. Scott & Co. completed No. 5 William Myers in section 5, Licking Township, in Clinton sand at 3,500 feet. It produced 50 bbls. the first day after shot. In the NW quarter of section 18, Hopewell Township, the Midland Oil Co. completed No. 5 Ella M. Denny through the Clinton sand to 3,170 feet. It made a very small showing of oil, and the shot collapsed the casing and it will probably be plugged.

In Noble County, Everett Bircher and others completed a test on the Everett Bircher farm in the SE quarter of section 33, Marion Township, in the Salt sand at 854 feet. It is a gas well gauging 400,000 feet a day with a shut-in pressure of 270 pounds and no oil showing.

In Perry County, Preston Oil Co., on the William Pettit farm in the NW quarter of section 17, Clayton Township, drilled into Clinton sand to 3,190 feet. It is a gas well gauging 200,000 feet a day. In section 28, Monroe Township, C. Z. Ruth completed No. 19 William Nuzum farm in the Berea sand at 1,005 feet. It produced 4 bbls. initially.

In Washington County, Lester Swingle and others completed No. 6 J. D. Murdock, 1 mile south of Wolf Creek, Lot 1,077, Palmer Township, in the First Cow Run sand at 615 feet. It produced 3 bbls. the first day after shot.

In Wayne County, Preston Oil Co. completed a second test on the J. W. Scholl farm, 1 mile east of Canaan, section 22, Canaan Township, in the Clinton sand at a depth of 3,279 feet. It produced 32 bbls. the first day after shot.

SOUTHWEST PENNSYLVANIA

Three gas wells were completed in Southwest Pennsylvania. In Greene County, on Laurel Run in Springhill Township, Nelson M. Richards, trustee, drilled a test on the Rossell Sammons farm into the Fifth sand to 3,320 feet. It gauges 360,000 feet a day from both the Fourth and Fifth sands.

In Richhill Township, Greene County, O. I. Dille test on the J. M. Phillips farm was good for 300,000 feet of gas from Gordon sand at 2,826-39 feet with gas at 2,829-33 feet.

In Washington County, George Gray completed a test on the Tombaugh farm in Somerset Township at 1,502 feet. The Salt sand was at 1,465 feet with 300,000 feet of gas at 1,499-1,502 feet.

In Morris Township, Washington County, Duquesne Gas Co. has rig up on the D. B. Hughes farm in Morris Township, and is is drilling No. 8 Carter Heirs, with 22,000 feet of gas at 2,834-37 feet and 147,000 feet of gas at 2,863-66 feet.

In Amwell Township, Carnegie Natural Gas Co. is down 2,035 feet in No. 4 N. B. Redd, and is rigging up the P. W. Reynolds test and building the F. M. Closser rig. A. V. Lewis and others are drilling at 800 feet in No. 2 Clarissa Ramsey in South Franklin Township. The Dunn Mar Oil & Gas Co. has reached 2,275 feet in No. 4 J. T. Baldwin. The Carnegie Natural Gas Co. is drilling No. 3 Alberta Iams at 1,668 feet.

In South Strabane Township, Penn Ohio Oil & Gas Co. is drilling at 2,753 feet on the Porter Brothers farm with the Gantz sand at 2,557-2,618 feet and an oil showing at 2,602 feet; Nineveh Thirty-Foot sand at 2,701-40 feet with 67,000 feet of gas at 2,707-08 feet. In North Strabane Township, Keystone Gas Co. is drilling at 2,275 feet on the J. T. Beabout farm. In Peters Township, R. M. Duden and others are drilling at 670 feet on the J. E. Johnson farm.

In Union Township, Beedle & Clark have shut down at 2,755 feet on the Maryin Rankin farm. In East Finley Township, Parkinson, Plants and others have rig up on the L. A. Phillips farm. In Smith Township, Horne Oil & Gas Co. is drilling on the A. C. Proudfit farm below 1,500 feet.

Greene County

In Washington Township, Greene County, Equitable Gas Co. is down 1,530 feet on the Pratt Yeager farm. Charles Mong has rig standing for No. 2 Jacob Johns, and Carnegie Natural Gas Co. has rig on the ground for No. 2 Sadie A. Connor.

In Morris Township, William Smith is drilling at 2,425 feet on the Fonner heirs farm. In Springhill Township, Union Gasoline & Oil Corp. is shut down at 3,273 feet on No. 5 T. M. Gallentine, testing casing. South West Pennsylvania Gas Corp. is drilling at 1,300 feet in No. 3 Thomas Smith. Taylor Oil & Gas Trust is down 720 feet in No. 5 John Taylor. J. H. McNichols & Co. are rigging No. 3 J. W. McNichols.

In Center Township, Carnegie Natural Gas Co. is underreaming the casing at 2,204 feet on the J. W. Milliken farm. The Rutan Oil Co. is down 2,050 feet on C. T. Harvey heirs lands. Charles Mong and others have reached 1,350 feet on No. 2 Jesse L. Metz (Weir) farm.

In Richhill Township, J. L. Blair is drilling at 1,000 feet in the No. 10 W. J. Bryan. Smith McCracken is underreaming on the Asa Hughes farm to 1,600 feet.

In Wayne Township, Equitable Gas Co. is drilling at 968 feet in No. 4 S. C. Brock. Manufacturers Light & Heat Co. is down 1,710 feet in No. 1 J. N. Johnson. In Dunkard Township, the Convex Glass Co. is drilling at 2,150 feet on the VanVoorhis farm.

Deep Tests

In Washington County, Norwood P. Johnston and others have reached 6,510 feet on the James McBurney farm in Mount Pleasant Township or 35 feet in the Onondaga limestone.

In Beaver County, John T. Galey and others are down 2,600 feet on the James Tennis farm in South Beaver Township. T. W. Phillips Gas & Oil Co. has reached 1,800 feet on the James Smith farm, same township. In Allegheny County, South Penn Oil Co. and others are still delayed by the same fishing job on the Christian Z. Schove farm. The tools were jarred but a broken center has them firmly lodged.

In Fayette County, Potter Development Co., William E. Snee and others are drilling at 3,100 feet in No. 2 Summit Hotel on Chestnut Ridge, South Union Township.

WEST VIRGINIA

In Pleasants County, Simon Axelrod completed No. 4 Mary Ratcliff in Washington district at 827 feet, in Salt sand, a 1-bbl well. In this district, Ward & Deem completed a 4-bbl. well on the Cassie Dye heirs farm at 1,240 feet, pay in Injun and Keener sands.

In Ritchie County, McBurney and others completed No. 6 M. B. Nutter, in Clay district, in Maxton sand at 1,710 feet and it is starting at 18 bbls. a day. E. B. Rich completed a 1-bbl. well on the Clark Scadden farm in Grant district at 2,038 feet, Squaw sand. In Clay district, McDougald Oil Co. completed a second test on the Jeff Barnard farm, good for 5 bbls. a day from the Squaw sand at 1,825 feet.

In Wood County, South Penn Oil Co. completed No. 22 Lewis Ogdin, in Union district, in Berea grit at 2,073 feet. It is showing for 10 bbls. a day.

Gas Wells

In Braxton County, Pittsburgh & West Virginia Gas Co. No. 7,631, Parkersburg Mill, Birch district, was completed at 1,692 feet. Second Salt sand was at 1,647 feet with 750,000 feet of gas at 1,680-91 feet.

In Cabell County, Swan Gas Co., on the A. J. Nicely heirs farm in McComas district, has a gas well at 3,235 feet; Berea at 2,132-43 feet; Brown shale at 2,480-3,235 feet, with gas at 2,137, 2,876, 2,986 and 3,167 feet. The Berea gas gauges 33,000 feet a day and the shale gas 152,000 feet a day.

In Calhoun County, Hope Natural Gas Co. completed No. 7,790, B. M. Siers farm, in Washington district, at 2,003 feet as a gas well; Big lime at 1,728-2,003 feet; with gas at 1,858-68 feet and 1,925-35 feet. It gauged 144,000 feet a day after shot.

In Doddridge County, Trainer Brothers completed a test on the Adam Wilson farm in New Milton district in Gordon sand at 2,521 feet and it is a gas well gauging 75,000 feet a day.

In Gilmer County, W. Hays Petry completed a large gas well in the test on the Gilbert Reed farm in Glenville district in the Big Injun sand at 1,486 feet. It gauges 5,000,000 feet a day. In this district, Gainer & Gunn completed a test on the William Lawrence farm in the Big Injun at 1,650 feet. It gauges 225,000 feet a day. In DeKalb district, Paul K. Weekley completed a test on the H. G. Woodford farm in the Maxton sand at 1,479 feet. It gauged 212,000 feet of gas at 1,468-79 feet. In Troy district, Wilson Brothers drilled a test on the F. B. Wilfong farm through the Injun sand to 1,610 feet and it is a small gas well.

(Continued on Page 252)

Kansas Developments

By DAL DALRYMPLE

STAFFORD DISCOVERY FLOWS 135 BARRELS IN THREE HOURS

The newest pool opener in Stafford County, Fred Rust and I. Nadel No. 1 Drach, NE NE SW section 12-22-13w, produced 135 bbls. of oil on first three-hour test and operators were due to take potential. The wildcat, 3 miles northwest of Hudson and southeast of the Gates pool, was bottomed at 3,705 feet, in Siliceous lime topped at 3,693 feet. Oil rose 1,250 feet in the hole in 20 hours, it then was swabbed at the rate of 20 bbls. in one hour, after which oil rose 3,100 feet in the hole over night before the three-hour test began. Gravity of the oil was 35.2 degrees. Although nearest production is in the Gates pool 3 miles northwest, the Drach well is thought to be on a northeast-southwest trend in alignment with the new Sittner pool. It was drilled on a farm-out from Stanolind Oil & Gas Co.

W. M. McKnabb No. 1 Blair, SW cor. section 7-30-1e, wildcat in northern Sumner County, was swabbing at the rate of 75 to 100 bbls. of oil daily. It is a Wilcox discovery, the sand being found at 3,866 feet, total depth 3,869 feet. Gravity of the oil is 47 degrees.

S. L. Parks and I. W. Murfin No. 1 Opdycke, SW cor. section 20-14-13w, wildcat 1 mile north of the Hall pool in Russell County, topped Siliceous lime at 3,170 feet, total depth 3,180 feet, oil rose 2,700 feet in the hole and on first test it produced 100 bbls. of oil in 12 hours. Some water was showing with the oil. Five-inch casing was set at 3,173 feet.

I. W. Murfin and others No. 1 Martin, SE NW section 18-28-1e, Sedgwick County, Wilcox sand discovery, pumped 475 bbls. of oil in 24 hours, down 8 hours. It pumped 52 bbls. the first hour and about 12 bbls. the last hour of the test. Gravity of the oil was 46.9 degrees. Top of Wilcox sand was 3,489 feet, total depth 3,491 feet.

H. Gussman and associates were rigging up rotary at No. 1 Oden, SE NE NW section 22-20-7w, in Rice County.

Albert Austin and others were moving in rotary tools at No. 1 Schwiethale, SW NE section 17-23-10w, wildcat in western Reno County, 13 miles northeast of Stafford and 8 miles northeast of production in the Zenith pool of Stafford County.

Skelly Oil Co. and others No. 1 Lunt, C NW section 18-28-11w, is location for a wildcat in Pratt County, southwest of the discovery gasser in that county.

Wildcat Completions

Fourteen wildcats were completed in Kansas the past week, with three opening new oil producing areas, two finding gas production and the remainder rating as no better than also-rans.

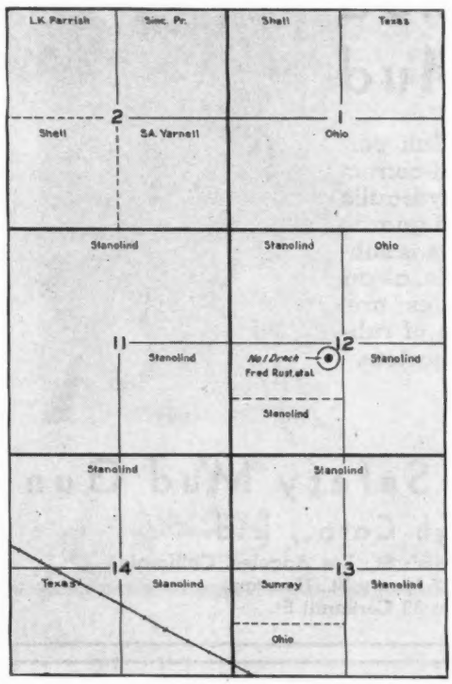
Two of the pool openers were in fast-stepping Barton County, and previously had been reported as pool openers although not completed until last week. One was the Shell Petroleum Corp. No. 1 Peterman, SE NE SE section 13-16-14w, northwest of Susank and south of the Trapp field. It swabbed 93 bbls. of oil naturally in three hours and, after acidizing, pumped 315 bbls. in the first four hours and 275 bbls. in the next four hours, gaining potential rating of 1,654 bbls. Production was from Siliceous lime found at 3,241 feet, total depth 3,366 feet. Top of anhydrite was 873 feet, Kansas City lime 3,073 feet.

The other Barton County discovery to be completed was National Refining Co., James A. Brouk and J. F. Duwe No. 1 Gory, NW NW SW section 10-17-13w, about 2½ miles south of the Ainsworth pool, had potential of 255 bbls. of oil daily. It found anhydrite at 802 feet, Kansas City lime 3,102 feet, Siliceous lime 3,342 feet, total depth 3,352 feet.

Gerbrand-Pulse Drilling Co. No. 1 Wellman, SW cor. section 22-21-9w, about 5 miles west of Sterling in Rice County, gauged 22,481,000 feet of dry gas and was completed at 3,327 feet, total depth. Kansas City lime was found at 2,939 feet, Conglomerate 3,308 feet.

A new area was opened in Russell County at Cities Service Oil Co. and others No. 1 Eichman, SW SW SE section 12-15-14w, north of the Ochs area. It made potential of 866 bbls. of oil after acid treatment. Top of anhydrite was 882 feet, Kansas City lime 3,073 feet, pay 3,103 feet, total depth 3,123 feet.

The other gas pool opener was in Sedgwick County at W. G. Talbott and others No. 1 Downs Estate, SE SE



Mid-Continent Map Co., Wichita

Fred Rust and I. Nadel have opened a new pool in Stafford County at No. 1 Drach, NE NE SW section 12-22-13w

NW section 32-28-2e, southeast of Wichita. It topped Stalnaker sand at 2,215 feet, total depth 2,232 feet, and produced 7,400,000 feet of gas.

Fred C. Chaddox and Atlantic Refining Co. No. 1 Slater, NE SW NE section 33-10-15w, Osborne County wildcat, topped Anhydrite at 1,225 feet, Kansas City 3,325 feet, Conglomerate 3,695 feet, Simpson 3,825 feet, had a hole full of water at 3,835 feet, total depth and was abandoned.

Other Failures

Morgan, Flynn, Cobb and others No. 1 McMillan, C NW section 9-13-37w, Logan County outpost, found Granite at 5,450 feet and was dry and abandoned at 4,465½ feet, total depth. Anhydrite was topped at 2,395 feet, Kansas City 4,065 feet, Mississippi 4,644 feet. Viola 4,967 feet, Simpson 5,075 feet, Siliceous lime 5,170 feet.

Phil-Han Oil Co. No. 1 Deines, NE NE NW section 33-14-14w, wildcat in Russell County, had anhydrite at 727 feet, Siliceous 3,183 feet and was dry and abandoned at 3,205 feet, total depth.

Aylward Production Co. and others No. 1 Berens, SE cor. section 10-14-16w, Ellis County wildcat, topped Siliceous lime at 3,480 feet, had a hole full of water at 3,490-93 feet, total depth, and was abandoned.

Earl Wakefield and associates No. 1 Zimmerman, SE SE SW section 7-16-18w, outpost in Rush County, had anhydrite at 1,239 feet, Siliceous lime 3,645 feet and was dry and abandoned at 3,664 feet, total depth.

Hinkle and others No. 1 Alden, SE SE SW section 17-17-10w, Ellsworth County wildcat, topped anhydrite at 585 feet, Kansas City lime 2,970 feet, Siliceous lime 3,326 feet, had a hole full of water and was abandoned at 3,331 feet, total depth.

Elbar Corp. No. 1 Ehlers, NE NE SE section 8-21-9w, Rice County wildcat, topped Simpson zone at 3,465 feet, Siliceous lime 3,523 feet and was dry and abandoned at 3,544 feet, total depth.

Kessler Oil & Gas Co. and others No. 1 Pinkston, NE NE NW section 17-22-14w, Stafford County wildcat, found anhydrite at 865 feet, Siliceous lime 3,915 feet, and was abandoned after getting a show of sulfur water at 3,939 feet, total depth.

Carter Oil Co. No. 1 Davis, NE NE section 24-28-8w, wildcat in Kingman County, found Simpson zone at 4,423 feet, Siliceous lime 4,538 feet, and was dry and abandoned at 4,571 feet, total depth.

Barton County

Completions in Barton County included 12 wells in addition to the wildcats. In the Ainsworth area, Stanolind Oil & Gas Co. No. 2 Zugg, NW NW NE section 34-16-13w, found Siliceous lime at 3,394 feet, total depth 3,398 feet, swabbed 65 bbls. of oil an hour and made potential of 1,814 bbls.

Eight wells were completed in the productive Silica-Peter-Ellinwood district in township 20-11w. Indian Territory Illuminating Oil Co. No. 1 Bryant, NE NE SE section 23-20-11w, Peter area, had Siliceous lime at 3,284 feet, total depth 3,303 feet, swabbed 292 bbls. of oil in eight hours, acidized and made potential of 1,956 bbls.

Magnolia Petroleum Co. No. 15 Roetzel, SE SW SE section 24-20-11w, had Siliceous lime at 3,252 feet, total depth 3,269 feet, acidized, pumped 383 bbls. of oil in eight hours, potential 1,301 bbls.

Indian Territory Illuminating Oil Co. No. 1 Schrepel B, NW NW SW section 25-20-11w, swabbed 372 bbls. of oil in 10 hours and made potential of 1,267 bbls. from Siliceous lime found at 3,298 feet, total depth 3,325 feet.

Same company's No. 2 Schrepel B, C N half N half SW section 25-20-11w, was completed as a water disposal well at 3,805 feet, total depth.

Stanolind Oil & Gas Co. No. 3 William Panning, SE cor. section 2-20-11w, had Siliceous lime at 3,283 feet, was bottomed at 3,292 feet, was acidized and made potential of 1,653 bbls.

Same operator's No. 5 William Panning, SW NW SE section 2-20-11w, was acidized and made potential of 2,248 bbls. of oil from Siliceous lime at 3,274 feet, total depth 3,292 feet.

Stanolind Oil & Gas Co. No. 1 Rose, SE SE NE section 3-20-11w, topped Siliceous lime at 3,302 feet, total depth 3,321 feet, acidized, potential 225 bbls. of oil.

Same company's No. 1 Stuckemann, NE NE SW section 11-20-11w, found Siliceous lime at 3,281 feet, total depth 3,302 feet, acidized, potential 330 bbls. of oil.

A trio of producers were completed in the Brefford-Kraft district. Darby Petroleum Corp. No. 2 Burmeister, SE SW SE section 3-17-11w, topped Siliceous lime at 3,286 feet, total depth 3,306 feet, acidized, pumped 342 bbls. of oil in four hours, potential 2,047 bbls.

Cities Service Oil Co. No. 2 Hogan, SW SE NW section 11-17-11w, topped Siliceous lime at 3,370 feet, total depth 3,375 feet, pumped 387 bbls. of oil and 136 bbls. of water, and later made potential of 909 bbls. of oil.

Transwestern Oil Co. No. 4 Meyers, NE cor. section 13-17-11w, was bottomed at 3,240 feet, acidized, pumped 207 bbls. of oil in four hours, and made potential of 1,045 bbls.

New work in Barton County: Stanolind Oil & Gas Co. No. 6 Schartz, SW SW NW section 2-20-11w, rig;

same company's No. 6 Panning, NE SE SE section 2-20-11w, rig; Shell Petroleum Corp. No. 3 Schneider A, NW NE NW NW section 1-16-14w, location; Stanolind Oil & Gas Co. No. 3 Zugg, NE cor. section 34-16-13w, set 10-inch casing at 260 feet; same company's No. 2 Thorne A, SW SE SE section 27-16-13w, set 10-inch casing at 246 feet; same company's No. 3 Stueder, SW cor. section 26-16-13w, rig; Shell Petroleum Corp. No. 1 Luerman, SW NW SW section 18-16-13w, rig; R. E. Hay No. 1 Feltes, SE SE NE section 14-16-12w, rig; Elmer Ash and others No. 1 Frees, NW cor. section 34-16-11w, moving in material.

Russell County

Twelve oil producers were completed in Russell County. In the Trapp district, Transwestern Oil Co. and others No. 2 Sadie Boomhower, SW SE SW section 19-15-13w, topped Siliceous lime at 3,302 feet, total depth 3,307 feet, was acidized and made potential of 1,183 bbls. of oil.

Coralena Oil Co. No. 6 Seliens, NW cor. section 30-15-13w, made potential of 884 bbls. of oil after acidizing Siliceous lime topped at 3,311 feet, total depth 3,313 feet.

Gulf Oil Corp. No. 10 Hoffman, SW cor. section 31-15-13w, found Siliceous lime at 3,261 feet, total depth 3,282 feet, acidized, pumped 204 bbls. of oil in four hours, potential 958 bbls.

Same company's No. 6 Mollie, NE NW SE section 25-15-14w, was acidized and made potential of 1,666 bbls. of oil from Siliceous lime topped at 3,317 feet, total depth 3,321 feet.

Other Russell County completions: Texas Co. No. 1 Schnoor, NE NE SW section 31-14-13w, Kansas City pay 2,953-60 feet, Gorham sand 3,107 feet, total depth 3,112 feet, pumped 35 bbls. of oil in one hour, potential 964 bbls.

Cities Service Oil Co. No. 5 Vaughn, NW NW SW section 17-14-14w, Kansas City lime 2,902 feet, pay 3,062-65 feet, total depth 3,069 feet, acidized, potential 1,902 bbls. of oil.

Hays & Sackrider and others No. 2 Boxberger, SE SW SE section 26-14-14w, Kansas City 2,902 feet, Granite Wash 3,156-98 feet, total depth, plugged back to 3,005 feet, acidized, potential 3,035 bbls. of oil.

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Central Petroleum Co. No. 5-C Foster B, NE SE NE section 3-14-15w, Gorham sand 3,299 feet, total depth 3,304 feet, potential 2,268 bbls. of oil.

Same company's No. 8 Foster B, NW SW NE section 3-14-15w, Gorham sand 3,306 feet, total depth 3,310 feet, shot, potential 1,575 bbls. of oil.

Stanolind Oil & Gas Co. No. 13 Mermis, SE NE NE section 5-14-15w, Kansas City 3,047 feet, pay 3,079-81 feet, total depth 3,106 feet, acidized, potential 206 bbls.

Same operator's No. 16 Mermis, SE NW NE section 5-14-15w, Kansas City pay 3,081 feet, total depth 3,110 feet, acidized, potential 222 bbls.

Hartman & Blair No. 8 Harbaugh, NW NW SW section 25-14-15w, Gorham sand 3,155 feet, total depth 3,162 feet, potential 1,351 bbls. of oil.

Smoky Hill Oil Corp. No. 14 Miller, NE SW SE section 30-14-13w, was reported as an abandoned rig.

Three new operations in Russell County were reported. Cities Service Oil Co. No. 7 Strecker A, NE SW NE section 35-14-14w, was a location. Phil-Han Oil Co. and others No. 1 Reinhardt, SE SE SW section 19-14-14w, location. Texon Oil Co. No. 3 Letsch, NE NW SW section 26-14-13w, drilling below 500 feet.

Estimated Daily Production

Estimated daily production of Kansas for the week ending November 6 and for the preceding week was as follows:

	Barrels	
	Nov. 6	Oct. 30
Oxford City	1,425	1,400
Burrton	11,650	13,350
Ritz-Canton	4,775	4,875
Graber	3,000	3,025
Hollow-Nikkel	2,300	2,375
Lerado	2,050	2,175
Voshell	2,200	2,275
Wellington	2,600	2,825
Ellsworth County:		
Lorraine	1,920	3,250
Other pools	1,230	985
Rice-Barton counties:		
Bloomer	2,150	3,325
Chase	6,125	6,200
Geneseo	2,075	2,475
Raymond	1,150	1,150
Silica	12,150	18,225
Keesling	1,000	1,025
Hauschild	1,475	2,000
Miscellaneous Rice	7,325	9,120
Miscellaneous Barton	6,220	7,065
Russell County:		
Fairport	2,285	2,150
Gorham	2,015	2,030
Russell	1,680	2,125
Sullivan	7,485	6,845
Trapp	12,905	12,420
Miscellaneous Russell	9,035	9,490
Sedgwick County:		
Valley Center	985	1,005
Miscellaneous	2,705	2,730
Ellis County:		
Bemis	4,900	5,075
Miscellaneous	2,775	2,875
Kingman County	560	580
Stafford County	2,490	2,875
Greenwood County	9,900	10,000
Butler County	16,075	16,120
Other fields	25,610	22,160
Total Kansas	174,225	185,600

Rice County

Continental Oil Co. and others No. 2 Michekls, SE NE SW section 12-18-8w, Geneseo area, Rice County, topped Siliceous lime at 3,188 feet, total depth 3,246 feet, was acidized, pumped 277 bbls. of oil in four hours and made potential of 1,622 bbls.

Same company's No. 2 Groth, SE SW SW section 32-20-7w, Saxman sector, found Conglomerate at 3,318 feet, total depth 3,340 feet, and pumped and flowed 690 bbls. of oil in 24 hours.

Gulf Oil Corp. No. 2 Lyons, NE cor. section 18-20-9w, had Siliceous lime at 3,298 feet, total depth 3,315 feet, pumped 149 bbls. of oil with 6 per cent water in four hours and made potential of 301 bbls. of oil, with 104 bbls. of water.

First reports of new activity in Rice County: Mid-Plains Petroleum Corp. No. 2 Hauschild, SE SE SW section 11-21-7w, rig; same operator's No. 3 Snyder, NW SW SE section 9-21-7w, cellar and pits; Atlantic Refining Co. No. 1 Oden, SW SW NW section 6-21-7w, moving in material; Continental Oil Co. No. 1 Peterson, SW SW SE section 10-20-9w, location; Indian Territory Illuminating Oil Co. No. 1 Lamberson, SW SW SE section 33-20-7w, location; Continental Oil Co. No. 2 Gum, SW NW SE section 34-19-10w, location.

Ellis County

Margay Oil Co. No. 7 Johansen, SE cor. section 22-11-17w, Bemis field, Ellis County, had Siliceous lime at 3,370-71 feet, total depth, and made potential of 2,724 bbls. of oil.

Carter Oil Co. No. 1 Karlin, NE NE NW section 1-12-18w, topped Siliceous lime at 3,833 feet and was dry and abandoned at 3,853 feet, total depth.

Bay Petroleum Corp. and others No. 1 Curtis, SE SE

SW section 1-13-18w, was acidized and made potential of 631 bbls. of oil from Siliceous lime topped at 3,599 feet, total depth.

New work in Ellis County: Bradley Oil Co. No. 1 Jensen, NW NW SE section 36-11-19w, location; Colonial Oil Co. No. 1 Hadley, SE NE SE section 12-11-18w, location; Ryan Consolidated Co. No. 3 Bemis C, NE SE SW section 21-11-17w, location; Lario Oil & Gas Co. No. 4 Romine, NE SW NW section 18-11-16w, drilling below 525 feet.

McPherson County

Continental Oil Co. and others No. 5 Huxman, NW NE NW section 29-21-1w, Graber pool, McPherson County, topped Hunton lime at 3,274 feet, total depth 3,305 feet, was acidized and made potential of 613 bbls. of oil.

Same company's No. 1 Jones A, NE cor. section 31-21-1w, found Hunton lime at 3,269 feet, was bottomed at 3,292 feet, acidized and pumped 520 bbls. of oil and 160 bbls. of water daily.

E. B. Shawver No. 1 Fletcher A, SW cor. section 16-19-1w, Ritz-Canton district, had Wilcox sand at 3,424 feet, total depth 3,446 feet, and produced 180 bbls. of oil daily.

Continental Oil Co. and others No. 1 Hetske, SE SW SW section 20-21-1w, was a location.

Rush County

Morgan & Flynn and others No. 4 Korll A, SE SE NW section 23-18-16w, Otis-Albert district, Rusk County, made potential of 1,047 bbls. of oil from Siliceous lime topped at 3,523 feet, total depth 3,558 feet.

Ness County

Continental Oil Co. No. 1 Everett, C W half SW SW section 7-18-25w, Aldrich area, Ness County, was completed as a water disposal well at 4,950 feet, total depth.

Ellsworth County

Skelly Oil Co. No. 1 Moran, SE cor. section 31-17-10w, Bloomer field, Ellsworth County, had Kansas City lime at 2,928 feet, was bottomed at 3,015 feet, acidized, flowed 1,157 bbls. of oil the first four hours, 1,130 bbls. the next four hours and made potential of 6,781 bbls. of oil.

Magnolia Petroleum Co. No. 1 Zine, SW NW SW section 32-17-10w, was a location. Marlyn Oil Co. and others No. 1 Stratman, NE NW SE section 33-16-10w, was a rig.

Stafford County

Stanolind Oil & Gas Co. No. 10 Komarek, NE SE NE section 30-22-11w, Richardson area, Stafford County, found Siliceous lime at 3,554 feet, total depth 3,580 feet, swabbed 35 bbls. of oil an hour, was acidized and made potential of 1,474 bbls. of oil, with 7 per cent water.

Same company's No. 10 Heyen B, SW NW NE section 31-22-11w, swabbed 90 bbls. of oil an hour and made potential of 1,965 bbls. of oil from Siliceous lime topped at 3,534 feet, total depth 3,542 feet.

Stanolind Oil & Gas Co. and others No. 1 Volker, SW SW NE section 23-24-11w, had Kansas City lime at 3,390 feet, sand 3,790 feet, total depth 3,801 feet, flowed 92 bbls. of oil hourly, made potential of 1,922 bbls. of oil.

Harvey County

E. J. Shaffer and others No. 3 Denno, C E half W half SW section 12-23-2w, Halstead pool, Harvey County, had Chat at 2,956 feet, was bottomed at 2,988 feet, plugged back to 2,981 feet and made potential of 538 bbls. of oil, with 53 bbls. of water.

Derby Oil Co. No. 1 Jerome, SW SW NE section 30-23-3w, Burrton field, found Chat at 3,262 feet, total depth 3,359 feet, flowed 43 bbls. of oil and 5 bbls. of water in 13 hours, was acidized, and made potential of 461 bbls. of oil, with a show of water.

Olson Oil Co. No. 6 Schrag, NE SE SW section 30-23-3w, was a rig. Same operator's No. 6 Nelson, SE NE NW section 30-23-3w, was a location.

Chase County

Smith & Polhamus No. 1 Leedy-Trees, C NE section 36-22-9, Chase County, had Bartlesville sand at 2,621 feet and was dry and abandoned at 2,660 feet, total depth.

Butler County

National Refining Co. No. 14 Lathrop, CSL N half NW section 17-23-4e, Elbing area, Butler County, had pay at 2,072-80 feet, total depth, and made potential of 85 bbls. of oil, with 6 bbls. of water.

Nat Wissman and others No. 1-A Schriber, SE SE SE section 3-26-4e, Eldorado field, found Siliceous lime at 2,404 feet, pay 2,424 feet, total depth 2,427 feet, pumped 184 bbls. of oil the first 24 hours, then 66 bbls. of oil and 25 bbls. of water. It was acidized, pumped 40 bbls. of oil and 18 bbls. of water, completed.

Sheldon & Wixson No. 3 Dohren, SE SE NW section 11-25-3e, had Mississippi pay at 2,707½-11 feet, total depth, pumped 48 bbls. of oil in 12 hours, was acidized, making potential of 100 bbls. of oil daily.

New work in Butler County: Polhamus No. 1 Albers, NW SW SE SE section 21-25-4e, drilling below 1,220 feet. Cox & McGinnis No. 3 Houston, NW NE SW section 1-25-3e, drilling below 685 feet.

Woodson County

Oko Oil Co. No. 1 Campbell, NW NW NE section 7-24-14, Winterscheid area, Woodson County, was bottomed at 1,726 feet, was shot and pumped 7 bbls. of oil daily.

Aikman & Braden and others No. 3 Massey, C NW SE section 35-23-14, was dry and abandoned at 1,661 feet, total depth.

Saco Oil Co. No. 7 Klick, SE SW SW section 20-25-14, had Bartlesville sand at 1,400 feet, total depth 1,426 feet, plugged back to 1,410 feet, was shot and pumped 37 bbls. of oil in four hours.

Pure Oil Co. No. 20 Winterscheid, C NW NE section 6-24-14, had spudded.

Sumner County

Stelbar Oil Corp. No. 4 Barlow, NE SW NE section 33-31-1w, Wellington pool, Sumner County, set 6-inch casing at 3,659 feet, was bottomed at 3,700 feet, acidized and made potential of 264 bbls. of oil.

Grant County

Panhandle Eastern Pipe Line Co. No. 1 McClelland,

(Continued on Page 260)

Discovery well of South Houston Field, Harris Co., Texas

ASKANIA

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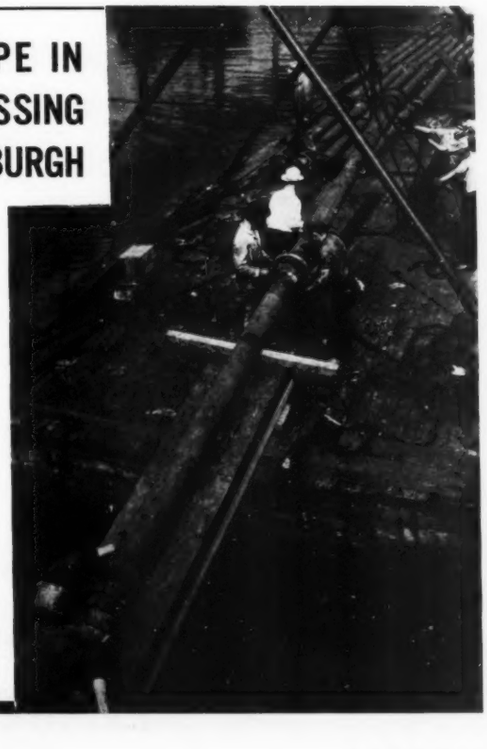

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West and North Texas

NEW POOL LOOMS IN PECOS; EXTENSIONS IN 3 COUNTIES

By
L. E. BREDBERG

FORT WORTH, Tex., Nov. 8.—The Pecos County sector of the Permian Basin assumed renewed importance this week when a rank wildcat, about 8 miles southwest of Fort Stockton, started showing for a producer, and a consequent discovery well.

In the northern end of the district, the recently discovered Denver area in the southwestern part of Yoakum County, is registering a 1½-mile northeastern extension, and two wildcat locations in that area, staked between the Denver field and the Wasson field, to the southwest, in northwestern Gaines County, may later prove connecting links to the two fields when they are completed.

Cochran, the most northern producing county in the West Texas district, saw the extension of its lone field in the southeastern corner of the county, by the Devonian Oil Co., which expanded the field 4½ to 5 miles from southeast to northwest.

The Humble Oil & Refining Co. apparently have a discovery in the making in No. 1 Belding (J. Bunger), in section 99, Block OW, 8 to 9 miles southwest of Fort Stockton, and about 8 miles south of the depleted Courtney-Pryor pool, which was opened about five years ago in a shallow pay horizon, but which later was depleted, and defined by several dry holes drilled in various directions from the small producers.

The new discovery is filling with low gravity oil. It logged the first showing at 2,450-51 feet, filling 500 feet with oil the first 20 minutes, later filling 1,100 feet in nine hours, the well continuing to drill ahead, and is now below 2,500 feet with the hole filled with oil. The 8⅝-inch casing had been set at 1,699 feet, and if more saturation is not picked up in deeper drilling, it will no doubt be plugged back and a nitroglycerin shot used in raising the oil or making a flowing producer of it. Gravity of the oil tested only 16.5 degrees. It is dark green in color.

The company holds considerable acreage in the area, and has staked two more locations on expiring leases, one of which will be an east offset to the promised discovery, and the second about one-half mile north of it, in section 104, Block OW.

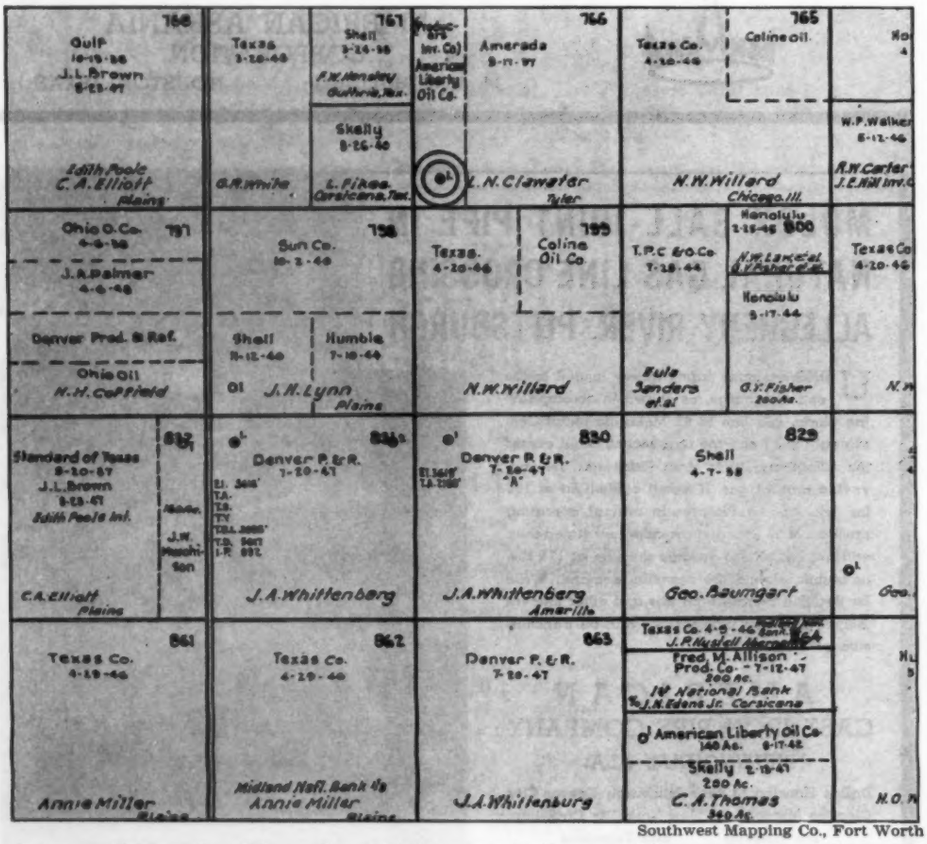
There is no pipe line outlet in this area, but in case a commercial well is uncovered, a loading rack can be erected along the railroad, which runs through the Belding ranch, and there is already a siding in the vicinity of the well. The oil can be shipped by tankcar to McCamey, where it could be pumped into Humble Oil & Refining Co. tanks.

Denver Extension

The Denver pool in southwestern Yoakum County is getting its second well and also a 1½-mile northeastern extension by American Liberty Oil Co. No. 1 Clawater, in section 766, Block D, John H. Gibson Survey. Total depth of the hole is 5,083 feet. The well is flowing 10 bbls. per hour following a 1,000-gallon acid treatment. It will be given another, possibly two more, acid treatments before it is completed. An estimated 2,000,000 feet of gas was coming with the oil.

This same company has made location for a southeast outpost to the pool on the A. C. Thomas lands, in the SW quarter of section 864, Block D, and is rigging up rotary. This location is about 2¾ miles southeast of the discovery well. Another location by the company is in Gaines County, one-half mile from the Yoakum County line, and about 1½ miles northwest of the most northeasterly producer in the Wasson field in northwestern Gaines County. This location is on the N. W. Willard lands, in section 38, Block AX, in the southwest quarter of the west 160 acres.

These two tests will be exceptionally important, due to their location in regard to the two fields, and in case they both prove producers will practically mean the connection of the two fields by production.



Southwest Mapping Co., Fort Worth

A new well in section 766, northeast of the recently discovered Denver pool in southwestern Yoakum County, is extending that pool nearly 1½ miles

Cochran Extension

The Duggan pool in southeastern Cochran County has been definitely extended a mile east by north, by Devonian Oil Co. No. 1 Duggan, located in Labour 11, League 55, Oldham County School Lands Survey. The hole was bottomed at 5,019 feet after an increase in oil was logged from 5,015 feet to the total depth. The hole filled 1,000 feet with oil overnight. P. N. Wiggins and others have a small well about 4½ miles northwest of the Duggan discovery, which is expected to be linked with the Duggan pool by intervening tests, and this new extension to the east will expand the field to a width of about 5 miles from southeast to northwest.

Pipe Line Connection

The Bennett field in southwestern Yoakum County which was primarily responsible for a big lease play and a wildcatting campaign in the northern tier of Permian Basin counties, is now connected to a 6-inch outlet of the Humble Pipe Line Co., via the Wasson field in northwestern Gaines County, Texas, and the Hobbs, New Mexico, field. Five wells in this field have been connected, and the outlet will no doubt result in the drilling of other tests in the area which was opened about two years ago by C. J. Davidson and others on the Bennett lands. The Denver field in the southwestern part of the county has also been given a connection by the Humble, a 4-inch line having been run into that field, in which there is only the discovery well. A second well is due for immediate completion and a couple of others are near completion.

Four miles west of the Denver area the Texas Co. is completing its test on the Walker lands, in section 794, Block D, a small pumper at a total depth of 5,162 feet, after plugging back from 5,180 feet to shut off water. Whether or not it will be tied into the Denver pool by production will not be known until other tests are drilled on acreage between them. If it does connect, a field about 10 miles in length from northwest to southeast, taking in the Denver and Wasson pools, will be established for this part of Yoakum and Gaines counties.

Gaines Extension

The Wasson field, opened about three months ago by Amon G. Carter and the Continental Oil Co., in the northwestern part of Gaines County, was given another mile southwest extension this week, when the Amerada Petroleum Corp. No. 1 Matthews, in section 417, Block G, pumped 185 bbls. of oil and 35 bbls. of water in 24 hours. It was previously drilled to 5,018 feet, but was plugged back to 4,998 feet to try to shut off water, which attempt was not altogether successful.

Bailey Bust

J. O. Whittington and others have abandoned their No. 1 McElvey, in Labour 12, League 162, Presidio County School Lands, at a total depth of 4,609 feet. This test is in the extreme southeastern corner of Bailey County, the most northwesterly test in the district. E. L. Wilson and others recently abandoned a test on the opposite side of the county, in the extreme

southeastern corner of same, and one other test is drilling in the area.

Abandonments

Two tests drilling in Reagan County have been abandoned. One, K. E. Sherman No. 1 W. E. Friend, located south of Big Lake, in the William Allen Survey, was given up at a total depth of 2,488 feet, and Moore Brothers No. 1 University, located in section 8, Block 7, was abandoned at a total depth of 3,073 feet.

CENTRAL AND NORTH CENTRAL TEXAS

The Avoca field in northeastern Jones County is apparently due for a mile extension to the northeast, but is being defined about 2 miles to the south by a dry hole. Fain & McGaha, Inc. and Sinclair Prairie Oil Co. are drilling the promised extension well in the NE quarter of section 190, B.B.B.&C. Survey, 1 mile north and a little east of the Iron Mountain Oil Co. discovery in section 196. This new test topped the pay at 3,213 feet and was shut down at 3,214 feet to underream the top of the pay, which is the Canyon limestone. The test checked slightly lower structurally than the discovery, and it will be carried deeper to test the section. If it proves a producer, it will mark the first important extension to the field, which is defined on the east and south.

West, Honea, Ungren and Frazier No. 1 Southard, in the SE quarter of section 202, 2 miles south of the discovery, was drilling near 3,500 feet, and is showing for a failure.

A northwestern Jones County wildcat, between Anson and Hamlin, was abandoned this week by Butler and Horne on the Mrs. Ramsey Cox lands. Location is in section 3, G.H.&H. Survey, and bottom of the hole is 2,792 feet.

On the eastern side of the county, Roeser & Pendleton, Inc., which just abandoned a dry hole 3 miles north of the Avoca field, is moving rig from this test to location on the Will W. Matlock farm in section 4, Block 15, T.&P. Survey, for a Palo Pinto (Canyon) lime test. This location is near a deep dry hole drilled a year ago by George Callihan, and is a mile south of the old Higgs shallow pool and a mile east of the Sandy Ridge shallow pool.

Taylor Showing

The wildcat test of Dale H. Dorn in southeastern Taylor County, located on the Hopkins lands, 1 mile northwest of View, and in Subdivision 20, section 120, Guadalupe County School Lands Survey, reported a 5-bbl. showing of oil from lime logged at 3,086 feet, the Adams Branch formation. It will be carried to the Palo Pinto lime, from which production is coming in the Avoca field in northeastern Jones County. Casing is now being underreamed from 2,800 feet, and a test will be made of the saturated streak before it is deepened.

Stonewall Failure

The southeastern Stonewall County test, drilled by Governor E. W. Marland of Oklahoma and Howard Drake of Oklahoma City, on the G. C. Carothers lands, has been abandoned at a total depth of 3,950 feet after striking sulfur water.

Ellenberger Strike

The Hickok Producing & Development Co. No. 1 Van Parmer, located in section 477, S.P.R.R. Survey, about 10 miles north of Cisco and in the northwestern part of Eastland County, has apparently opened the first Ellenberger production for the county. It topped the Ellenberger at 4,018 feet, logging saturated lime at 4,024-25 feet, where it was shut down to run tubing under pressure, and make a production test. The Illinois Pipe Line Co. will tie into the well when it is completed.

A couple of other such producers were completed in past years, one by Chestnut & Smith, about 5 miles southwest of this new strike, and another between Cisco and Eastland, in the same county, but both later went to water and were abandoned.

Lone Star Gas Co. and the Hickok Co. hold large acreage in the area surrounding the test, which is an important one for Eastland County, as it may influence the drilling of other Ordovician tests in the area.

Panhandle District

The wildcat test drilling by the Texas Minerals Co. on the Norton farm in section 123, Block 2, G.H.&H. Survey, struck salt water at 3,174 feet and is to be plugged back to test upper gas showings. An estimated 1,000,000 feet of gas showed from 3,005 feet, with an increase logging at 3,035 and 3,077 feet. Elevation is 3,278 feet. Acid will be used on the formations in an effort to increase the gas output.

The M. & E. Oil Co. No. 1 Grogan, located in section 100, Block 22, H.&G.N. Survey, in Collingsworth County, will probably be abandoned as it also struck water. at 2,477 feet, following a small showing of oil at 2,456 feet.

WEST TEXAS COMPLETIONS

Andrews County

Humble Oil & Refining Co. No. 31 J. S. Means, 3,500-30 feet, acidized, 258 bbls. through seven-eighths inch choke; No. 13 R. M. Means, 3,500-67 feet, acidized, 544 bbls. on pump.

Crane County

Texas Co. No. 33 King, 2,338-97 feet, acidized, 242 bbls. on pump.

Ector County

Cities Service Oil Co. No. 5-B Cummins, 4,200-50 feet, acidized, 806 bbls. W. H. Dunning, Jr. No. 6-A Scharbauer, 4,138-4,225 feet, acidized, 1,806 bbls. through three-quarters inch choke. Gulf Oil Corp. No. 46 Goldsmith, 4,173-4,205 feet, acidized and shot, 1,224 bbls. Humble Oil & Refining Co. No. 3-C Scharbauer, 4,150-4,202 feet, acidized, 216 bbls. Landreth Oil Corp. No. 8-D Scharbauer, 4,170-4,230 feet, acidized, 1,580 feet; No. 6-E Scharbauer, 4,170-4,220 feet, acidized, 872 bbls.; No. 3-G Scharbauer, 4,170-4,212 feet, acidized, 1,336 feet. Shasta Oil Co. No. 5 Scharbauer, 4,160-4,210 feet, acidized, 1,593 bbls. through three-quarters inch choke. Shell Petroleum Corp. No. 4-B Cummins, 4,149-4,243 feet, shot and acidized, 130 bbls. on pump. Texas Pacific Coal & Oil Co. No. 10 Scharbauer, 4,205-70 feet, shot and acidized, 1,811 bbls.

Reagan County

Moore Brothers Corp. No. 1 University, dry and abandoned 3,073 feet, elevation 2,864 feet.

Gaines County

Amerada Petroleum Corp. No. 1 Brand, junked and abandoned 4,484 feet. R. H. Gill No. 1 Simpson, dry and

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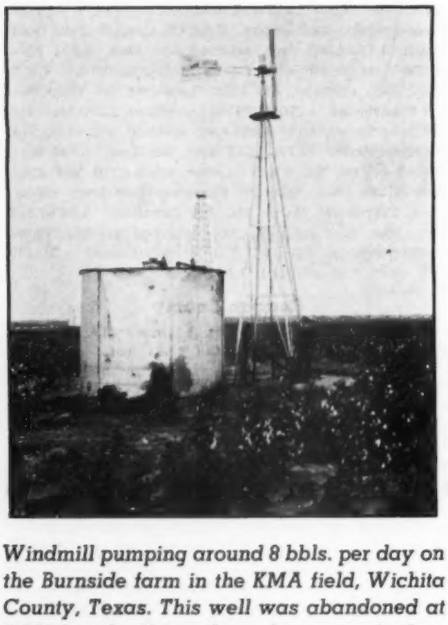

Windmill pumping around 8 bbls. per day on the Burnside farm in the KMA field, Wichita County, Texas. This well was abandoned at 3,046 feet, but later showed a scum of oil on top of casing. The farm owner rigged up the windmill and ran tubing and rods and is pumping the well. It is on the east side of the field near new eastern extension to deep pay

abandoned 5,502 feet, elevation 3,226 feet. Ohio Oil Co. No. 1 Averitt, 5,027-73 feet, acidized, 168 bbls.

Howard County

Ed S. Holman No. 1 T. P. Land Trust, dry and abandoned 2,570 feet, elevation 2,749 feet. Royal Oil & Gas Co. No. 15 Dora Roberts, 2,498-2,573 feet, plugged back to 2,566 feet, acidized, 1,124 bbls. on pump.

Pecos County

Amerada Petroleum Corp. No. 5-A University, 1,646-54 feet, acidized, 161 bbls. C. S. Messenger No. 2 Byrne, 1,350-78 feet, shot, 125 bbls. fluid, 20 per cent water. Samwan Oil Co. No. 7 Masterson, 1,335-1,471 feet, shot, 409 bbls. Stanolind and others No. 12-C Tippett, 381-421 feet, 11 bbls. on pump.

Sterling County

Snowden & McSweeney No. 1 Harris, dry and abandoned 1,864 feet, elevation 2,386 feet.

Upton County

Anderson Oil Co. No. 1 Cordova Union, 2,155-2,205 feet, plugged back to 2,184 feet, acidized, 72 bbls. on pump. A. D. Devore No. 6 Burleson, 2,128-66 feet, acidized, 827 bbls. Eppenauer Drilling Co. No. 4-A Lane, 2,065-2,118 feet, acidized, 702 bbls. on pump. Alf Reece, Jr. No. 2 Burleson, 2,348-89 feet, acidized, 938 bbls. on pump. Stanolind Oil & Gas Co. No. 46 Burleson, 2,105-49 feet, acidized, 71 bbls. oil and 10 bbls. water on pump. Williams and Williams No. 6 Robbins, 2,120-66 feet, acidized, 390 bbls. on pump.

Ward County

Gulf Oil Corp. No. 54 Estes, 2,530-2,620 feet, shot, 1,280 bbls.; No. 89 Hutchins, 2,512-2,730 feet, shot, 1,565 bbls. Humble Oil & Refining Co. No. 19-F University, 2,559-2,745 feet, shot, 918 bbls. Texas Pacific Coal & Oil Co. No. 11 Barker, 2,202-2,395 feet, shot, 416 bbls. Yaeger and Armstrong No. 1-A White, 2,166-2,233 feet, 70 bbls.

Winkler County

Illinois Oil Co. No. 15-A Central State Bank of Abilene, 2,790-3,085 feet, shot, 861 bbls. Magnolia Petroleum Co. No. 15 Colby, 2,905-3,110 feet, shot, 251 bbls.; No. 11 Scarborough, 2,855-2,980 feet, shot, 24 bbls.; No. 108 Walton, 2,825-2,931 feet, shot, 860 bbls. Richardson Oils, Inc. No. 3-E Scarborough, 2,863-3,010 feet, shot, 523 bbls. J. R. Sharp No. 1-A Walton, 3,306-3,458 feet, shot, 100 bbls. Sinclair Prairie Oil Co. No. 1-D Cummins, 3,028-60 feet, 1,133 bbls.; No. 4-B Vaden, 2,160-3,045 feet, shot, 560 bbls. Skelly Oil Co. No. 7-A Leck, 2,755-3,015 feet, shot, 384 bbls. through three-quarters inch choke. Texas Pacific Coal & Oil Co. No. 2 Duval, 3,025-77 feet, 499 bbls.

PANHANDLE COMPLETIONS

Carson County

Gulf Oil Corp. No. 21 Cooper, 3,029 feet, shot, 284 bbls. on pump; Northern Oil Co. No. 5 Cooper, 3,157 feet, shot, 675 bbls. on pump. Texoma Natural Gas Co. No. 4-M McLaughlin, 2,450-2,640 feet, 18,400,000 feet gas. United Crude Oil Co. No. 4-A Cooper, 3,203 feet, shot, 744 bbls. on pump.

Gray County

Cities Service Oil Co. No. 7-B Archer, 3,280 feet, shot, 671 bbls. on pump. Kewanee Oil & Gas Co. No. 5-C Morse, 2,612 feet, shot, 289 bbls. on pump. King Oil Co. No. 11 Castleberry, 3,280 feet, shot, 545 bbls. on pump; No. 8 Thompson, 3,279 feet, shot, 555 bbls. on pump. Magnolia Petroleum Co. No. 11 Haggard, 3,297 feet, shot, 575 bbls. on pump. Sinclair Prairie Oil Co No. 4 Carey, 3,100 feet, shot, 455 bbls. on pump. Smith Brothers No. 1 Castleberry, 3,295 feet, shot, 825 bbls. on pump.

Hutchinson County

Danube Oil Co. No. 4 Starnes, 3,160 feet, shot, 1,039 bbls. on pump. Kerlyn-Timms No. 1 Haile, 3,012 feet, plugged back to 3,000 feet, shot, 55 bbls. on pump. Phillips Petroleum Co. No. 4 Thompson, 3,217 feet, shot, 637 bbls. on pump. Rogan Oil Co. No. 2 Kay, 3,216 feet, shot, 965 bbls. on pump. Stanolind Oil & Gas Co. No. 6-A Haile, 3,088 feet, shot, 400 bbls. on pump.; No. 7-A Haile, 3,025-71 feet, shot, 778 bbls. on pump; No. 10 Moore, 3,075 feet, shot, 205 bbls. on pump; No. 12-B Ware, 2,983-3,112 feet, shot, 240 bbls. on pump; No. 3 Watkins, 2,860-92 feet, shot, 389 bbls. on pump.

Moore County

Phillips Petroleum Co. No. 1 Loeber, 3,325 feet, plugged back to 3,197 feet, shot, 29,900,000 feet gas; No. 1 Ochsner, 3,398 feet, plugged back to 3,305 feet, 49,800,000 feet gas. Texoma Natural Gas Co. No. 2-M Coon-Sneed, 2,682-3,290 feet, 34,300,000 feet gas.

New York-Pennsylvania Fields

COUDERSPORT, Pa., Nov. 8.—Two wells were completed and a new location reported in the New York-Pennsylvania deep sand gas fields during the week ended November 6.

G. L. Cabot, Inc. completed its test on the Thomas Murphy farm, Alma Township, Allegany County, New York, with an initial open flow of 8,400,000 feet. This well reached the Oriskany at 4,713 feet and encountered the gas flow 4 feet in the sand. The initial rock pressure was 1,110 pounds.

Fairman and others' test on the C. Wilson farm, Willing Township, same county, proved a failure after drilling 7 feet into the Oriskany. This well was drilled to 4,991 feet where it filled up with salt water. The top of the Oriskany was at 4,984 feet. The well was plugged and abandoned.

The new location was staked by the Empire Production Co., 700 feet from the south and 800 feet from the west lines of the Della Mulvey farm in Alma Township, Allegany County.

Pennsylvania Operations

Potter Development Co. is drilling by the tools lost at 5,674 feet in its test on the Haupt farm in West Branch Township and remains shut down at 6,062 feet on the Crawford Estate farm, Keating Township, two Potter County wildcat operations.

Five other Potter County wells are drilling: G. L. Cabot, Inc., at 5,209 feet on the R. Johnston farm and New York State Natural Gas Co. at 1,690 feet on the A. D. Marble farm and at 2,168 feet on the A. Schofield No. 2 farm. P. P. & L. Co. is drilling by the bailer lost at 4,970 feet on the G. M. Whitman farm. The Cabot test is in Bingham Township and the others in Harrison. Ward Wasson is drilling at 2,475 feet on R. B. Hall farm in Genesee Township.

G. L. Cabot, Inc. has yet to begin operations on the location on the Orwin & Carlson farm in Wharton Township and French and others are now shut down at 400 feet on the Mary Webster farm, another Genesee Township test.

Updegraff got a show of salt water at 4,600 feet in his wildcat test on the O. E. Erickson farm in Elk Township, Warren County, but is drilling deeper and is now down to 4,615 feet. Two other Warren County tests are shut down, Kane Industrial Gas Co. at 4,435 feet on Lot 515, Watson Township, and Evjen and others at 3,700 feet on the Dusenberry farm, same township. Belmont Quadrangle Drilling Co. is down to 1,960 feet on Lot 487, Pleasant Township, fourth current test in this county.

The H. C. Drilling Co.'s well on the Van Scoy farm, Hamilton Township, was shot Wednesday at 4,770 feet. It is producing 10 bbls. of salt water along with 108,000 feet of gas per day.

New York Operations

Two of the fifteen Woodhull Township, Steuben County, operations are drilling in the Onondaga, Oriskany sand caprock, and should be completed in the near future. The current status of operations in this new field follows:

Belmont Quadrangle Drilling Co. shut down at 4,017

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feet on the L. S. Johnson farm. This test topped the Onondaga at 3,993 feet. This company is also moving in on the John Allen farm.

G. L. Cabot, Inc., is running casing in its well on the C. Groves farm which has been drilled to 4,138 feet, 17 feet in the Onondaga which was reached at 4,121 feet.

Southwestern Development Co., cooperators in the discovery well, has three operations under way and is drilling at 485 feet on the E. G. Husted farm, at 85 feet on the Earl Brown farm, and is preparing to drill on the J. Seeley farm.

New York State Natural Gas Co. is drilling at 485 feet on the Chester L. Bonham farm and is spudding in a second well on the Charles Finch farm.

Hanley & Bird are drilling 1,505 feet on the E. H. Ackerman No. 1 farm and at 3,403 feet on the J. Lobeck farm where the Tully limestone was found at 3,297-3,351 feet.

J. Becker is drilling at 1,130 feet on the Fred Sly farm.

Cunningham Natural Gas Co. is drilling at 3,000 feet on the J. J. Johnson farm.

Sylvania Corp. is spudding in on the John Allen farm.

Chancy and others are building the rig on the M. Hargraves farm.

New York State Natural Gas Co. is also drilling at 2,640 feet on the A. Schaul farm, Troupsburg Township, Steuben County, and has a location staked on the Franklin Miller farm, this township.

Sylvania Corp. is drilling at 280 feet on the E. G. Husted farm in Jasper Township, Steuben County.

Only two other New York operations are under way in other counties, Southwestern Development Co., held up by a fishing job at 5,576 feet on the Federal Land Bank farm in Montour Township, Schuyler County, and building a rig on its location on the Johnson estate farm, Willing Township, Allegany County.

Rocky Mountain Runs

Production estimates for week ended November 6:

WYOMING

	Bbls.
Salt Creek	16,460
Big Muddy	1,390
Badger Basin	250
Black Mountain	200
Byron	4,560
Dallas Derby	590
Dutton Creek	50
Elk Basin	30
Frannie	2,210
Garland	2,450
Grass Creek	820
Hamilton dome	2,340
Hidden dome	340
Hudson	310
LaBarge	990
Lance Creek	12,260
Lost Soldier	1,270
Medicine Bow	4,900
Mule Creek	80
Midway	60
Oregon Basin	7,330
Osage	820
Pilot Butte	20
Quealy dome	700
Rock River	2,820
South Casper	500
Poison Spider	370
Teapot	30
Wertz	310
Total Wyoming	64,460

MONTANA

Border	150
Cat Creek	580
Cut Bank	10,330
Dry Creek	40
Kevin-Sunburst	5,160
Pondera	1,490
Total Montana	17,750

COLORADO

Florence	160
Fort Collins and Wellington	250
Iles dome	2,620
Moffat	480
Orchard	40
Rangely	80
Tow Creek	130
Price	410
Total Colorado	4,170

NEW MEXICO

Cooper	5,450
Eaves	1,060
Eunice	28,060
Hardy	1,400
Hobbs	16,290
Jal	1,150
Langlie	2,490
Lynch	680
Lynn	360
Mattix	2,140
Monument	29,480
North Lynch	60
Penrose	4,040
Rhoades	120
Skelly	1,680
South Eunice	2,190
Vacuum	80
Artesia-Maljamar	6,820
Getty	200
Hogback	200
Rattlesnake	810
Table Mesa	100
Total New Mexico	104,860
Total Rocky Mountain region	191,240

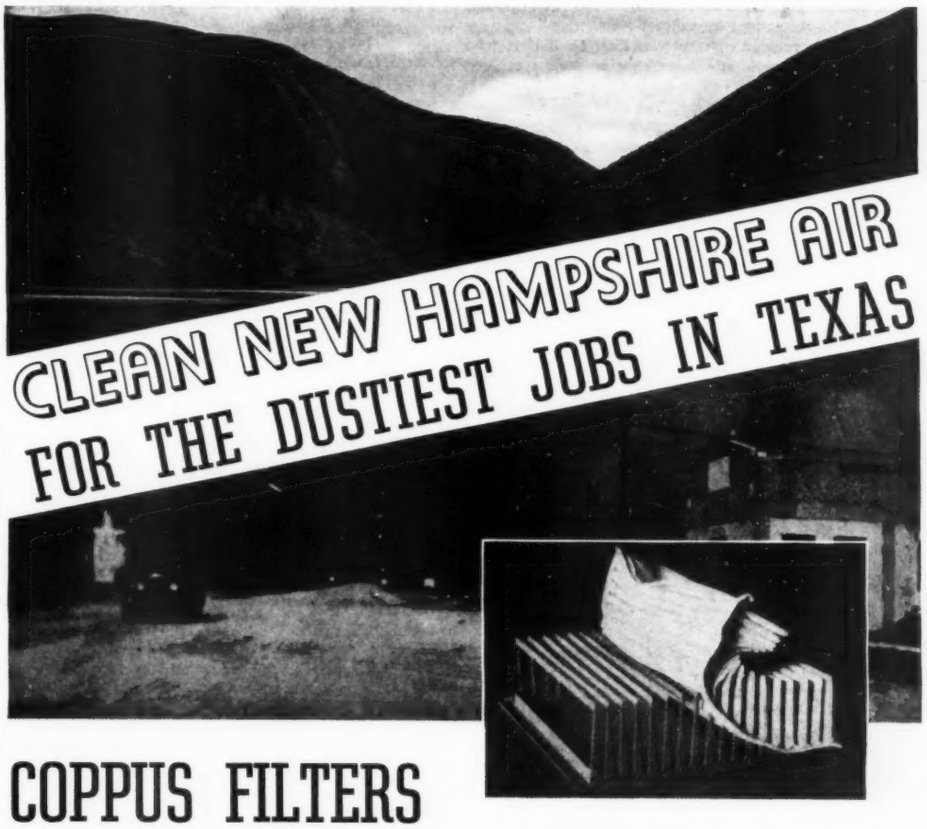
Rumania Displaces U. S.

The United States' losses in petroleum trade during the first half of this year with Greece have been transferred to gains for Rumania. During much of 1936 difficulties between Rumania and Greece over currency and rates of exchange diverted most of the Greek business to the United States and other suppliers.

The relative positions of the United States and Rumania were almost exactly reversed during the first half of 1937. During the first half of 1936 the United States supplied 706,520 bbls. of liquid petroleum products to Greece and for the same period this year the volume dropped to 138,227 bbls. On the other hand, Rumania supplied only 257,652 bbls. during the first half of 1936 contrasted to 848,361 bbls. for the first six months of the current year.

The relative positions of the United States and Rumania in supplying Greek demand for petroleum are shown in the following tables (figures in U. S. barrels):

	United States 6 months		Rumania 6 months	
Products—	1936	1937	1936	1937
Fuel oil	511,793	74,114	142,559	595,697
Gasoline	173,605	34,540	42,371	206,642
Kerosene	1,876	10,959	70,710	45,912
Lube oil	19,246	18,614	2,012	110
Total	706,520	138,227	257,652	848,361



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North Louisiana, Arkansas

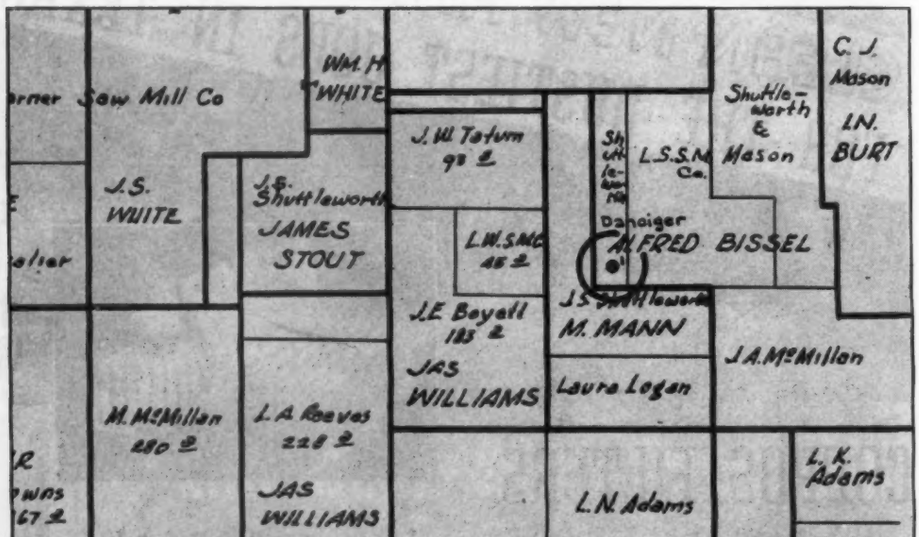
By MITCHELL TUCKER

NEW ARKANSAS POOLS KEEP IN FOREGROUND OF INTEREST

SHREVEPORT, La., Nov. 8.—Attention in the Ark-La-Tex area continues to be centered on Arkansas where rapid development is being made in the Schuler, Rodessa and Buchner fields.

Proration of the Arkansas portion of the Rodessa field which was to go into effect November 1, was delayed at the request of Governor Carl E. Bailey, who has made the public statement that he does not favor restriction of oil production in the state at this time. The order, which was published, and rescinded, provided for a top allowable of 10,000 bbls. per day for wells in this portion of the Rodessa field, based on 50 per cent acreage and 50 per cent bottom-hole pressure.

Last week the 36 producers in Rodessa, Arkansas, yielded an average of 14,424 bbls. daily, or an average of 401 bbls. per well per day. Seven new completions were made during the week. During the same period the 418 producers on the Louisiana side of the field produced 40,914 bbls. per day, or an average of 98 bbls. per well. Three completions were made there. Allowable for this portion of the field is 50,000 bbls. daily, but the wells are incapable of making this amount. On the Texas side of Rodessa, the 363 producers yielded 27,334 bbls. per day, or 76 bbls. per well.



Walter E. Wylie, Maps, Shreveport

Danciger Oil & Refining Co.'s closely watched wildcat in Panola County, Texas, No. 1 J. W. Tatum, Alfred Bissel Survey, which is now testing and showing gas in beds of lower Trinity

RODESSA COMPLETIONS

Miller County, Arkansas

Anding & Bird No. 2 Skipper, section 11-2-28, flowed 16 bbls. hourly on initial test through one-quarter inch tubing choke, tubing pressure 150 pounds, casing pressure 700 pounds, total depth 6,103 feet.

F. W. Burford No. 2 A. A. Capps, E half W half of fractional section 14-20-28, flowed 75 bbls. daily with 3,000,000 feet of gas, total depth 6,089 feet.

F. W. Burford No. 2-B G. G. Gerald, section 15-20-28, flowed 18 bbls. hourly, one-half inch tubing choke, total depth 6,070 feet.

F. W. Burford No. 3 Ahren, section 10-20-28, flowed 15 bbls. hourly, total depth 6,088 feet.

G. C. Grasty No. 1 Treadway, SW SE NE section 10-20-28, flowed 724 bbls. in 14 hours, three-quarters inch tubing choke, total depth 6,148 feet.

R. H. Long No. 1 Greer, SW NE SE section 10-20-28, flowed 60 bbls. hourly, 1-inch tubing choke, casing pressure 500 pounds, total depth 6,118 feet.

Kroll and Travis No. 1 Dickson, SW SE NW section 11-20-28, flowed 20 bbls. on 10-hour initial test, after acidizing with 2,000 gallons, total depth 6,169 feet.

Caddo Parish, Louisiana

Gulf Production Co. No. 2 Campbell, section 4-23-16, flowed 110 bbls. in 24 hours, total depth 6,061 feet.

Surf Oil Co. No. 1 Allison, NE section 8-23-16, flowed 40 bbls. per day on gas lift, total depth 6,050 feet.

Standard Oil Co. of Louisiana No. 3 McCoy, NE NE SW section 10-23-16, flowed 30 bbls. hourly, total depth 5,959 feet.

Cass County, Texas

American Liberty Oil Co. No. 5 Maxie, John Collom Survey, flowed 137 bbls. daily through one-quarter inch tubing choke, total depth 5,905 feet.

R. W. Norton No. 3 W. and E. Starke, D. Gillam Survey, flowed 130 bbls. daily, three-eighths inch tubing choke, total depth 6,025 feet. No. 4, same lease and survey, flowed 159 bbls. daily, one-eighth inch tubing choke, total depth 6,025 feet.

Union Production Co. No. 4 Belote, H. Holbert Survey, flowed 75 bbls. daily, total depth 5,982 feet.

Union Production Co. No. 1-A Starke, D. Gillam Survey, flowed 80 bbls. daily through one-quarter inch tubing choke, total depth 6,050 feet.

Marion County, Texas

In the Jefferson area, of Marion County, Gulf Production Co. No. 2 L. Henderson, R. Bennington Survey, flowed 738 bbls. in 24 hours on initial test through three-eighths inch tubing choke, tubing pressure 350 pounds, casing pressure 1,390 pounds, total depth 6,061 feet. Interest is high in this area as new completions continue to log greater thicknesses of saturated Henderson and Gloyd lime. Outpost tests of this area to the northwest and to the south are to reach the testing stage next week.

NORTH LOUISIANA

Bossier Parish

Triangle Drilling Co. No. 1-A Schuler Estate, SE NW section 13-17-12, flowed 100 bbls. daily through open tubing from a newly opened upper oil level in the Sligo field, total depth 3,118 feet.

Caddo Parish

The southern Caddo Parish wildcat west of Caspiana, Prairie River Syndicate No. 1 Hutchinson, section 15-15-12, which is bottomed at 9,141 feet for orders after logging several sand bodies in the Lower Marine beds showing gas and distillate, has been taken over by Union Producing Co. for deepening to the Permian lime zone. Only one other well in the North Louisiana territory has been carried to this level, that being R. W. Norton's 12,000-foot test at Rodessa. Completion of oil producers at Schuler, Arkansas, makes the Permian a more attractive deep objective.

D. C. R. Oil Co. No. 1 Dickinson, SW SW NW section 15-19-14, Caddo field, flowed 100 bbls. daily, total depth 2,465 feet.

W. H. Harrison No. 2 Shoreline-Crystal fee, NW SE NW section 25-21-16, has been abandoned as dry, total depth 1,021 feet.

Louisiana Oil Producing Co. No. 13-B Muslow, SE NW SW section 4-20-15, pumped 150 bbls. initially, total depth 2,146 feet.

Surf-Maji Oil Co. No. 3 Self, SE section 10-20-15, pumped 175 bbls. daily, total depth 2,193 feet.

Lisbon Field Extension

Three-quarters of a mile north of Lisbon production, T. L. James No. 1 Baker, NE section 25-21-5, has been completed as a pumper, producing 135 bbls. in 14 hours, total depth 5,222 feet in Pettit lime. This well was formerly abandoned as dry, but was later reentered, acidized and completed as a producer.

De Soto Parish

About 2½ miles northeast of the Holly field, Kingston Oil Co. No. 1 Scott logged oil saturation from 2,748-65 feet, and at a total depth of 2,765 feet casing is being set preparatory to testing.

Claiborne Parish

Although daily allowable at the Lisbon field is 10,000 bbls., the field only produced 3,270 bbls. daily last week, due to a lack of pipe line outlet. However, the Caddo Pipe Line Co. is completing its new line into the field, and will immediately begin taking oil. It is expected that the total allowable can now find an outlet, Gulf Pipe Line Co. taking one-third and Caddo Pipe Line Co. taking two-thirds.

In the Lisbon field, R. L. Bauman No. 2 C. S. L. Patton, NW SW NE section 1-20-5, flowed 97 bbls. hourly through 1-inch tubing choke, total depth 5,368 feet.

A. O. Olson No. 1 W. H. Patton, S half SE SE section

26-21-5, flowed 35 bbls. hourly through 9/64-inch tubing choke, total depth 5,273 feet. Same operator's No. 4-A T. F. Patton, N half SE SW section 30-21-5, flowed 250 bbls. in three hours on initial test through 1-inch tubing choke, total depth 5,197 feet.

LaSalle Parish

Buck Granshaff and others No. 1 Russell, SW NE NW section 25-10-1e, pumped 5 bbls. per day, total depth 1,514 feet, in the Urania field.

In the same field, Petroleum Heat & Power Corp. No. 1 Wright, NW SE SE section 26-10-1e, flowed 200 bbls. daily, total depth 1,521 feet.

Sabine Parish

The Hunter Company No. 1 H. L. Bowman, NW section 13-7-13, was completed in the Zwolle field last week as one of the best producers there in years, flowing 15 bbls. hourly through three-sixteenths inch tubing choke. After three days production, the rate of flow was being well sustained.

A deep test, possibly to 10,000 feet, is being planned for the Blue Lake portion of the Zwolle field. Charles H. Lawrence, Jr. and associates have assembled the block, including mostly lands of lumber companies in the territory. H. D. Easton, Shreveport geologist who picked the location for Swolle's discovery well, is also geologist on the deep test.

Webster Parish

Two additional deep gas-distillate producers were completed in the Bodcaw sand zone of Cotton Valley last week. Ohio Oil Co. No. 1 D. W. Merritt, SW section 14-21-10, flowed 364 bbls. per day with 4,000,000 feet of gas, five-sixteenths inch tubing choke, total depth 8,365 feet.

Woodley Petroleum Co. No. 2-B L. C. Cox flowed 376 bbls. of distillate in 10 hours, with 5,000,000 feet of gas, through 9/32-inch tubing choke, total depth 8,140 feet.

Union Parish

Joe Modisett and others No. 1 Frost, section 14-21-1, wildcat test northeast of Farmerville, is running protective casing at a total depth of 4,350 feet. Gas showings were reported above this depth.

Standard Oil Co. of Louisiana has entered into an agreement whereby they will take over operations of this test and carry it to a total depth of 7,000 feet in the Travis Peak. The location is on a "trend" which is receiving much play following the Schuler, Arkansas, deep discoveries. The Standard company holds extensive blocks of acreage in this region which were to be tested soon, but further wildcatting may now be delayed until No. 1 Frost is deepened to the lower objective.

Estimated Daily Production

Estimated daily gross production all companies week ending November 6:

NORTH LOUISIANA

	Bbls.
Bellevue	840
Caddo light	3,880
Caddo heavy	2,650
Converse	655
Cotton Valley heavy	465
Cotton Valley light	*3,800
De Soto and Red River	1,500
Elm Grove	400
Haynesville	3,095
Holly	95
Homer	2,465
Lisbon	3,270
Pleasant Hill	125
Rodessa	40,915
Sarepta-Carterville	325
Sligo	175
Sugar Creek	365
Urania	2,740
Zwolle	640
Total	68,400

SOUTH ARKANSAS

Champagnolle	1,320
El Dorado	1,935
Lisbon	285
Miller County	465
Nevada	735
Rodessa	14,425
Schuler	6,810
Smackover light	2,100
Smackover heavy	16,770
Stephens	580
Troy	1,150
Urbana	1,200
Total	47,775

Texas side of Rodessa field 27,335 bbls. daily.

*3,315 bbls. is distillate.

ARKANSAS

Union County—Schuler Field

Total daily average production from the three sands at Schuler was 6,810 bbls. last week. At present 14 wells are drilling to the 7,600-foot level, seeking production in the basal Travis Peak or Permian.

The Arkansas Board of Conservation held a hearing on the Schuler field on November 5, considering spacing, drilling regulations and completion practices.

Columbia County

The discovery well at Buchner, Columbia County, Arkansas, continues to increase its rate of flow as additional penetration is taken in the Permian lime. At the present total depth of 7,259 feet, after logging a total of 49 feet of formation showing oil of varying porosity. Standard Oil Co. of Louisiana No. 1 J. P. McKean, SW section 8-16s-22w, swabbed 173 bbls. in three and one-half hours, and began flowing, averaging 23 bbls. per hour for the next eight hours, with a gas-oil ratio of 260 feet per barrel. This is an increase from the previous rate of 16 bbls. hourly from a total depth 7,239 feet. The last 10-foot core taken from 7,249-59 feet showed medium hard dense lime with low saturation, and slightly brackish taste. The well will probably not be deepened below its present total depth.

Tide Water-Seaboard No. 1 Crumpler, SW NE SW section 24-17-19w, wildcat test in the Village area, about 4 miles north of Springhill, La., is now coring below 6,250 feet, expecting to enter the Permian lime at any time.

EAST TEXAS (Border Counties)

Panola County

Danciger Oil & Refining Co. No. 1 J. W. Tatum, Trinity test in the Alfred Bissel Survey of southeastern Panola County, is testing and showing rather impressive gas volumes, after perforating casing from 6,187 to 6,285 feet, total depth 6,350 feet. This well is on a 13,000-acre block about 15 miles south of the Bethany field and about the same distance north of

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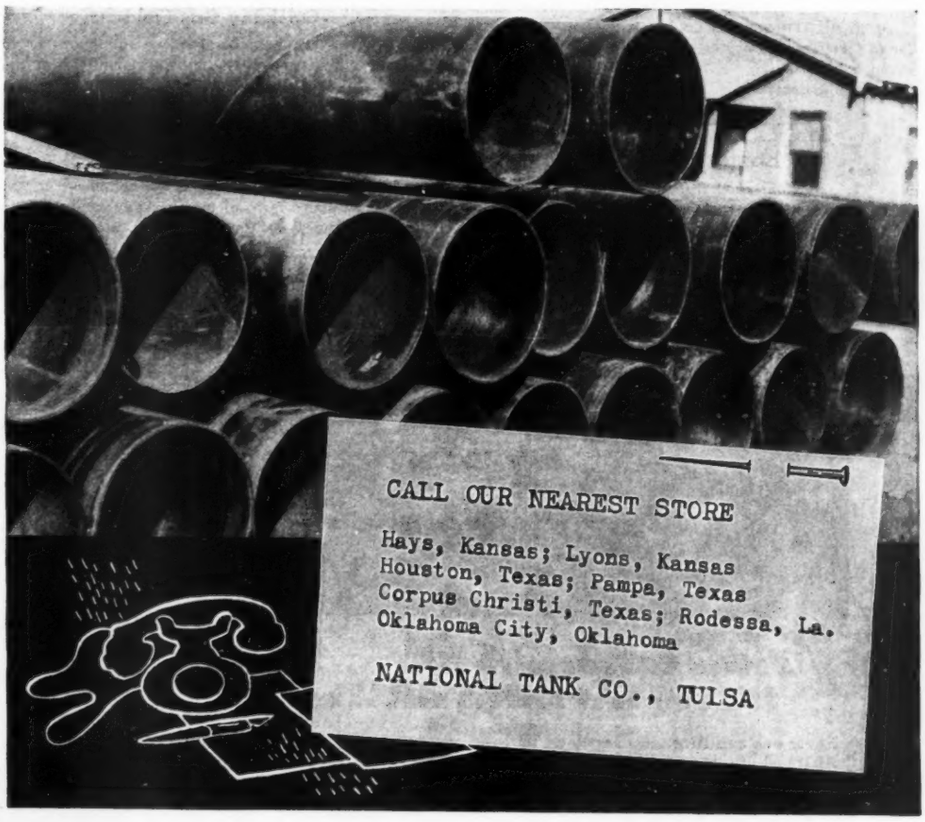
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gas distillate production opened in Shelby County by Portex Oil Co.

Magnolia Petroleum Co. No. 2 Hull, Applewhite Survey, deep test of the Lower Marine, total depth 8,717 feet, continues to wash over 4-inch drill pipe and cut section after section. Fishing is now at 7,145 feet.

Harrison County

Testing continues at Highway Eighty Oil Co. No. 1 George, interesting wildcat in the J. S. Powell Survey, after logging oil saturation in the Tokio, total depth 2,481 feet. Fruid level, mostly oil, is standing at 1,200 feet, and standard pumping rig will be installed. This was originally planned as a Glen Rose Trinity test, but apparent commercial production at this upper level will delay the deep test.

MISSISSIPPI

Wilkinson County

Charles Green No. 1 Foster Creek Lumber Co., section 4-3n-1e, has been abandoned as dry at 4,048 feet.

Bolivar County

Phillips Petroleum Co. No. 1 Pertshire, section 2-24n-7w, wildcat test of the Paleozoic section, has been abandoned as dry at 6,009 feet. Their diesel rig at this location has been moved into Perry County, Mississippi, and is rigging up for the drilling of their No. 1 J. J. Newman Lumber Co., section 21-2n-16w.

Hinds County

Southern Natural Gas Co. is rigging up for a proposed 7,000-foot wildcat test upon their geophysically mapped high in the NE NW section 35-6n-4w, on the Angelo Williams farm.

Eastern Fields

(Continued from Page 242)

In Kanawha County, Ajax Gas Co., on the Dunbar Development Co. tract in Union district, completed a well at 4,095 feet; Brown shale at 3,050-4,093 feet, with 236,000 feet of gas per day after a shot at 3,055-75 feet.

In Marion County, S. N. Elliott completed a test on the Gordon K. Atha farm in Mannington district at 2,950 feet, Gordon sand, and it gauged 750,000 feet a day.

In Marshall County, Hope Natural Gas Co. completed No. 7,779, on the Joshoua Yoho farm in Liberty district, at 2,189 feet. The top of the Injun sand was 2,115 feet with 450,000 feet of gas at 2,181-88 feet. In this district, the Manufacturers Light & Heat Co. completed No. 2 C. J. Hoffman in the Fifth sand at 3,107 feet and it is good for 450,000 feet a day.

In Monongalia County, Pittsburgh & West Virginia Gas Co. completed No. 3 Myrtle C. Brand in Clay district at 3,215 feet, the Bayard sand. It gauges 134,000 feet a day.

In Ritchie County, P. O. Burgy and others completed a test on the P. C. Moats farm in Union district in the Injun sand at 1,725 feet. It is good for 250,000 feet a day.

In Wayne County, Owens-Illinois Glass Co. completed the J. G. Lambert test in Union district at 3,360 feet. Brown shale was at 2,533-3,060 feet with gas gauging 1,800,000 feet a day at 2,690, 2,798, 2,808 and 3,054-3,350 feet. The Mountaineer Gas Co. completed No. 2 Otto Adkins at 3,485 feet, with Brown shale at 2,630-3,484 feet and 148,000 feet of gas at 2,540, 2,910, 2,950 and 3,205 feet.

In Wetzel County, Browns Run Gas Co.'s test on the A. L. Lough farm in Clay district had Fifth sand at 2,975 feet and is a gas well good for 70,000 feet a day.

Oriskany Gas Field

In Elk district, Kanawha County, Columbian Carbon Co.'s test on the Robert N. Orth farm had top of the Oriskany sand at 4,903 feet and 238,000 feet of gas showing at 4,945 feet, with the tools still in the hole. On the Viola Wolfe farm, this company topped the Oriskany sand at 4,973 feet and have 248,000 feet of gas showing at 5,039 feet and is still drilling. In the same district, Columbian Carbon Co. completed a test on the J. W. Jones farm in the Oriskany sand at 4,972 feet and it gauges 4,000,000 feet a day. Its test on the Nona J. Fogarty farm in this district was shot and the volume increased to 8,150,000 feet a day.

In Elk district, Poca Fork Oil & Gas Co. completed No. 2 David M. Canterbury in the Oriskany sand topped at 5,035 feet. At 5,063 feet the well was good for 3,013,000 feet a day. Benedum-Trees, Inc, completed a test on the S. B. and L. D. Pauley farm at 5,045 feet with the Oriskany sand at 5,012 feet and the gauge 2,889,000 feet a day. The Pond Fork Oil & Gas Co. initial well in the field was completed on the Crowder and Thomas farm, Elk district, and at 5,209 feet it was good for 213,000 feet a day.

In Poca district the test of the Mullins Gas Co. on the Campbell and Odell lease increased after shot to 5,288,000 feet a day. The United Carbon Co. No. 1 H. F. Miller and others increased to 3,425,000 feet a day with total depth of 4,934 feet after shot.

Two new locations were made in Poca district. The West Virginia Gas Corp. made a location for No. 2 O. A. Vandine and others, 1½ miles southeast of Sissonville, and a surface elevation of 862.4 feet. The United Fuel Gas Co. made location for No. 4,786 C. C. Fisher, about three-quarters of a mile south of the J. E. and M. D. Good large gas well.

Outside Deep Tests

In Wirt County, Carnegie Natural Gas Co. is drilling at 3,800 feet in the test on the W. O. Caplinger farm in Tucker district. In Tygart district, W. H. Bickel is drilling at 3,960 feet in the test on the Reese Blizzard farm.

In Wood County, Belmont Quadrangle Co. is down 2,237 feet in a test on the C. D. White farm in Steel district. In Clay County, Pittsburgh & West Virginia Gas Co. has reached 2,000 feet in a test on the Jesse Chapman farm in Otter district.

In Roane County, Ohio Valley Gas Co. is drilling at 5,300 feet in a test on the M. C. Larch and others lease in Harper district. This is 46 feet in the Corniferous lime and the well should reach the Oriskany within the week. W. H. Petry is shut down at 4,179 feet in a test on the D. O. Curry farm in Ravenswood district, Jackson County.

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Rocky Mountain Area

By
T. R. INGRAM

THREE-MILE EXTENSION OF VACUUM AREA IS INDICATED

DENVER, Colo., Nov. 8.—The Gulf Oil Corp.'s deep test in eastern Colorado is reaching a critical stage at 5,875 feet. Location was released by Ed Solomon for test to the red beds in eastern Pueblo County. There were no completions in Colorado.

The Ohio Oil Co. completed a 400-bbl. well in the Sundance on the southeastern edge of the Rock River field in Wyoming and the Argo Oil Co. No. 4 Ford, in Lance Creek, was completed for 173 bbls. per day in the Minnelusa. Osage field in Weston County showed a revival of drilling upon assurances of a market for the oil. Six locations were made in that field, one of which may go to the Minnelusa. The Ohio Oil Co. made one location in Rock River and another in Lance Creek.

Northern Montana fields had the expected crude price cut. Only one well, which was not tested, was completed in Cut Bank, and two in Kevin-Sunburst. The Model Oils, Ltd., test on the Anaconda dome near the Canadian boundary, had water in the top of the Madison and was abandoned.

NEW MEXICO

The Vacuum area of Lea County held attention of New Mexico oil operators the past week as the Texas Co. No. 1-L State, C SW NE section 1-18-34, showed to extend the pool 3 miles to the south. It flowed 48 bbls. of oil an hour for four hours, with 3,250,000 feet of gas, while drilling below 4,346 feet in lime. An increase of oil was reported at 4,346 feet, and it previously had sprayed 15 bbls. of oil daily from upper pays. The outpost logged showing of gas at 4,234-39 feet; rainbow shows of oil from 4,245-50 feet and 4,252-54 feet, increase in gas from 4,282-84 feet and 4,286-88 feet, with more oil at 4,297 feet. The well was said to be running more than 50 feet higher structurally than the highest of three wells in the Vacuum pool and has yet to tap the prolific pays in which Magnolia Petroleum Co. No. 2 State-Bridges, farthest southwest well in the area, had natural flow of 51 bbls. hourly.

Repollo Oil Co. No. 1 Cowden, NE cor. section 31-23-37, wildcat 3 miles northeast of lime production in the Cooper field and 2 miles northwest of sand production, swabbed 22½ bbls. of oil in four hours while bottomed at 3,624 feet. It had first oil show at 3,542-44 feet, an increase at 3,550 feet, made two small heads after finding more oil at 3,601-11 feet, with another gain at 3,618-20 feet, with the oil rising 2,000 feet in the hole.

Skelly Oil Co. No. 1 Combest, NW SE section 27-23-36, wildcat between the Cooper and Lynn areas, was showing oil and gas through 12-pound rotary mud while coring lime at 3,501 feet. The first of a series of cores bleeding oil was found at 3,884-90 feet.

In western Lea County, Emperor Oil Co. No. 1 Johns Permit, C SW NW section 24-17-32, was spraying an unestimated amount of oil when shut down at 4,198 feet, total depth, in lime. Gas gauged 3,000,000 feet from 3,335-40 feet, and oil shows were logged at 3,835-45 feet and 4,009-12 feet.

Ralph A. Shugart and others No. 1 Coulthard, C NW SW section 35-18-31, wildcat 10 miles from production in eastern Eddy County, had increases in showings of oil when deepened from 3,447 feet to 3,453 feet. Pay was topped at 3,440 feet, and oil was reported standing 2,500 feet in the hole. A swabbing test was being made.

Completions of the past week in Lea County, southeastern New Mexico, included the following:

Stanolind Oil & Gas Co. No. 1-B Gilluly, C NW SW 25-20-36, on the northwest edge of the Eunice pool, flowed 114 bbls. of oil in eight hours after acid treatment. Top of pay was 3,806 feet, total depth 3,854 feet. Production was through three-quarters inch choke on tubing. Gas volume was 212,000 feet.

Texas Pacific Coal & Oil Co. No. 6-A State, C NW NE section 7-22-36, South Eunice, flowed 90 bbls. of oil an hour through casing, with 6,000,000 feet of gas, at 3,826 feet, total depth.

Stanolind Oil & Gas Co. No. 1 State, C SE SE section 16-24-37, was bottomed at 3,540 feet, and flowed 7 bbls. of oil an hour thrugh tubing after a shot.

Great Western Production Co. No. 1 State, C SE SE section 16-26-37, in the Rhodes gas area of southeastern Lea County, had gas pay at 3,146 feet, total depth 3,277 feet, and produced 50,000,000 feet of gas.

Culbertson & Irwin No. 2-A Humphrey, NE NE NW section 3-25-37, flowed 124 bbls. of oil in 10 hours after a shot at 3,474 feet, total depth.

Continental Oil Co. No. 3-A-26 State, C SW NW section 26-19-36, was bottomed at 4,024 feet, plugged back to 3,924 feet, was shot, flowed 38 bbls. of oil daily and produced 2,200,000 feet of gas.

Same company's No. 6-A-30 Lockhart, NE SE NW section 30-21-36, plugged back to 3,920 feet from 3,996 feet, total depth, was acidized and flowed 98 bbls. of fluid in 12 hours, 56 per cent of which was oil.

Lea County

Amerada Pet. Corp. No. 6 Byrd, SE sec. 12-20-36. Loc.
Amerada Pet. Corp. No. 2 Corrigan, C S½ SE NE sec. 4-22-37. Drk.
Amerada Pet. Corp. No. 1 Hare, C SW SW sec. 33-21-37. T.D. 3,600 ft.; set 6⅝-in. 3,596 ft.
Amerada Pet. Corp. No. 3 Laughlin, C NW NE sec. 9-20-37. T.D. 2,585 ft.; set 8-in. 2,573 ft.
Amerada Pet. Corp. No. 1 Stuart, C W½ NW NW sec. 14-25-37. Drlg. 3,328 ft.
Anderson-Prichard Oil Corp. No. 1 Wells, C SE SE sec. 5-27-37. Drlg. 3,575 ft.
Anderson-Prichard Oil Corp. No. 1 Gregory, NW sec. 33-25-37. T.D. 3,237 ft.; tstg.
Anderson-Prichard Oil Corp. No. 2 Langlie, SE sec. 8-25-37. T.D. 2,466 ft.; shot; C.O.
Anderson-Prichard Oil Corp. No. 3 Langlie, NE sec. 8-25-37. T.D. 1,220 ft.; set 9⅝-in. 1,187 ft.
Anderson-Prichard Oil Corp. No. 1-D Langlie, NE sec. 8-25-37. T.D. 3,455 ft.; tstg.
Bradley Oil Co. No. 1 Grizzell, C SW NE sec. 5-22-37. Drlg. 3,578 ft.; est. 1,000,000 ft. dry gas.
Cities Service Oil Co. No. 7-A Closson, C W½ SE NE sec. 6-22-36. T.D. 3,775 ft.; set 7-in. 3,755 ft.
Cities Service Oil Co. No. 8 Closson, C W½ NE sec. 6-22-36. Loc.
Cities Service Oil Co. No. 1-H State, C NE NE sec. 17-22-36. T.D. 3,884 ft.; prep. to deepen.
Cities Service Oil Co. No. 1-A Closson, C NE NE sec. 18-22-36. Wildcat; drlg. 1,870 ft.
Continental Oil Co. No. 1-B-6 Elliott, C NE SE sec. 6-22-37. T.D. 3,435 ft.; set 5½-in. 3,424 ft.
Continental Oil Co. No. 2-B-6 Elliott, C NW SW sec. 6-22-37. Drlg. 2,702 ft.
Continental Oil Co. No. 3-B-6 Elliott, C SE SE sec. 6-22-37. T.D. 1,188 ft.; set 7⅝-in. 1,182 ft.
Continental Oil Co. No. 1-B-10 Britt, SW sec. 10-20-37. T.D. 3,875 ft.; flwd. ½ B.O. hourly; tstg.
Continental Oil Co. No. 3-B-31 Lockhart, SE sec. 31-21-36. Drlg. 3,710 ft.
Continental Oil Co. No. 1-A Jack, C SW SW sec. 21-24-37. Drlg. 2,850 ft.
Continental Oil Co. No. 1-B-24 Reed, C SE SW sec. 24-20-36. Drlg. 3,410 ft.
Continental Oil Co. No. 2-B-24 Reed, SW sec. 24-20-36. T.D. 285 ft.; set 10¾-in. 279 ft.
Continental Oil Co. No. 4-A-14 Sanderson, C NE SE sec. 14-20-36. Drlg. 3,598 ft.
Continental Oil Co. No. 5-A-14 Sanderson, NE NE NW sec. 14-20-36. Drlg. 3,042 ft.
Continental Oil Co. No. 6-A-14 Sanderson, SE sec. 14-20-36. T.D. 1,201 ft.; set 7⅝-in. 1,201 ft.
Continental Oil Co. No. 1-A-7 State, SE sec. 7-19-37. T.D. 1,438 ft.; set 7⅝-in. 1,425 ft.
Continental Oil Co. No. 2-E-17 State, C NE SE sec. 17-22-36. Cellar.
Continental Oil Co. No. 6-A-17 State, C NW NE sec. 17-19-37. Cellar.
Crandall, Osmond & Maxwell et al No. 1 Maxwell Permit, C SE SE sec. 2-11-36. Drlg. 4,665 ft.
Cranfill & Germany No. 1 Weir, C NE NE sec. 15-20-37. T.D. 4,210 ft.; S.D.O.
Culbertson & Irwin No. 3-A Humphrey, NE SW NE sec. 3-25-37. T.D. 3,410 ft.; flwg. by hds.; tools stuck.
Eastland Oil Co. No. 1 Waldrop, C SE SE sec. 1-20-38. T.D. 120 ft.; bldg. drk.
Emperor Oil Co. No. 1 Johns, C SW NW sec. 24-17-32. T.D. 4,198 ft.; H.F.O.
Empire O. & R. Co. No. 1-G State, sec. 2-21-36. T.D. 3,900 ft.; S.D.
Empire O. & R. Co. No. 2-B State, C SE SW sec. 2-21-37. Drlg. 3,850 ft.
J. E. Farrell No. 2-C Walden, C SE SW sec. 15-22-37. Drlg. 3,665 ft.
Gulf Oil Corp. No. 1 Boyd, sec. 23-22-37. T.D. 3,681 ft.; tstg.
Gulf Oil Corp. No. 2 Cole, C NE NE sec. 16-22-37. T.D. 1,141 ft.; S.D.
Gulf Oil Corp. No. 1 Elliott, SW SE SE sec. 15-25-37. Drlg. 3,380 ft.
Gulf Oil Corp. No. 1-E Janda-State, NE NW NE sec. 21-23-36. Drlg. 1,200 ft.
Gulf Oil Corp. No. 1-B Stebbins, NE sec. 5-22-37. Drlg. 2,552 ft.
Gulf Oil Corp. No. 1 Felton, C SE SE sec. 28-21-36. T.D. 3,885 ft.; flwd. 150 bbls. fluid in 12 hrs., 4% wtr.; 9,000,000 ft. gas.
Gulf Oil Corp. No. 1-B Shipp, C NW SW sec. 8-19-37. Drlg. 3,906 ft.
Gulf Oil Corp. No. 1-B White, SE sec. 35-20-36. Drk.
Herschback Oil Co. No. 1 Alexander, C NE SW sec. 5-21-37. T.D. 3,533 ft.; set 5½-in. 3,509 ft.
Herschback Oil Co. No. 1 Burleson, C E½ NE NW sec. 8-25-37. R.U.R.
Humble O. & R. Co. No. 2 Fopeano, C SE NE sec. 35-20-36. Drlg. 3,740 ft.
Humble O. & R. Co. No. 3 Williams, C SW NW sec. 34-24-37. T.D. 3,532 ft.
Humble O. & R. Co. No. 1 Fopeano, C SE SW sec. 25-20-36. Pay 3,714 ft.; T.D. 3,860 ft.; acd.; flwd. 12 B. O.P.H.
Humble O. & R. Co. No. 2 Saunders, C NW NW sec. 9-22-34. Drlg. 3,970 ft.; flwd. 74 B.O. in 3 hrs.; tstg.
Jal Nat. Gas Corp. No. 2 Justis, NE sec. 20-25-37. T.D. 3,029 ft.; tstg.
Carl B. King No. 1 Stuart, NW SW SW sec. 11-25-37. T.D. 1,050 ft.; set 7⅝-in. 1,048 ft.
Landreth Prod. Co. No. 1 Grizzell, NE sec. 8-22-37. T.D. 3,739 ft.; acd.
Landreth Prod. Co. No. 2 Grizzell, C SW NE sec. 8-22-37. R.U.R.
Magnolia Pet. Co. No. 1 State G, NW NW NE sec. 34-17-34. T.D. 4,905 ft.; P.B. 4,794 ft.
Magnolia Pet. Co. No. 2 State-Bridges, sec. 14-17-34. T.D. 4,593 ft.; flw. 51 B.O. in 1 hr., naturally.
Magnolia Pet. Co. No. 3 State-Bridges, C SW SE sec. 23-17-34. T.D. 340 ft.; W.O. U.R.
J. A. Mascho No. 1 Cloyd, C SE SE sec. 20-22-23, wildcat. Drlg. 3,255 ft.
McDonald & Weiner No. 1 Elliott, SE cor. sec. 19-21-37. T.D. 3,778 ft.; flwd. 120 B.O.P.D.; T.P. 3,755 ft.
C. T. McLaughlin No. 1 Polhamus, NE sec. 9-24-37. Drlg. 2,790 ft.
Mid-Continent Pet. Corp. No. 2 Boren, C SE NE sec. 20-22-36. T.D. 3,840 ft.; to acd.
Murray et al No. 4 State Wallace, NW SW NW sec. 3-21-36. T.D. 3,840 ft.; acidized; flwd. 67 B.O. daily.
National Drlg. & Prod. Co. No. 1 Flint, C NE NE sec. 29-20-34, wildcat. Drlg. 3,653 ft.
Ohio Oil Co. No. 2 Grizzell, C NW SE sec. 5-22-37. T.D. 3,600 ft.; prep. to drill in.
Ohio Oil Co. No. 1 Hardy, NE NE SE sec. 20-21-37. Drlg. 2,935 ft.
Ohio Oil Co. No. 1 Kutter D, C SW SW sec. 18-19-37. Drlg. 3,535 ft.
Ohio Oil Co. No. 7 State-McDonald, C SW SE sec. 16-22-36. T.D. 3,871 ft.; C.O.
Lem Peters No. 1 Graham, sec. 27-22-37. Drlg. 350 ft.
Plains Prod. Co. No. 1 Humphreys, NE sec. 3-25-37. Loc.
Plains Prod. Co. No. 1 Stuart, NE SW SW sec. 10-25-37. Drlg. 3,315 ft.
Repollo Oil Co. No. 1 Carter, SW SE NE sec. 9-24-37. T.D. 3,787 ft.; P.B. 3,660 ft.; flwd. 80 B.O.P.D.
Repollo Oil Co. No. 1 Powhatan Carter, SW SW NE sec. 9-24-37. Loc.
Repollo Oil Co. No. 3 Christmas, NW NW NE sec. 28-22-37. Drlg. 490 ft.
Repollo Oil Co. No. 1 Cowden, NE cor. sec. 31-23-37. T.D. 3,620 ft.; 2,000 ft. O.I.H.; C.O.
Repollo Oil Co. No. 3 Moseley, SW sec. 34-24-37. Drlg. 730 ft.
Repollo Oil Co. No. 4 Roach, NW NW SW sec. 21-20-37. T.D. 3,875 ft.; drlg. out plug.
Repollo Oil Co. No. 1-B State, NE NE NW sec. 7-22-36. Loc.
Repollo Oil Co. No. 1 Turner, sec. 29-21-37. Drlg. 1,810 ft.
Repollo Oil Co. No. 1 White, SE NE SE sec. 35-20-36. T.D. 3,860 ft.; acidized; flwd. 582 B.O. in 14 hrs.
Republic Prod. Co. No. 1 Davis, SW cor. sec. 34-23-36. Drlg. 3,550 ft.
Rowan Drlg. Co. No. 2 Elliott B, C NW NW sec. 9-22-37. T.D. 1,200 ft.
Rowan Drlg. Co. No. 2-A Elliott, C NE SW sec. 27-22-37. Drk.
Rushwold Oil Co. No. 1 Mattix, NE sec. 10-24-37. Cellar and pits.
Samedan Oil Co. No. 3 Hughes, sec. 4-23-27. T.D. 3,631 ft.
Samedan Oil Co. No. 4 Hughes, C NW SE sec. 10-23-37. Drlg. 2,325 ft.
Shell Pet. Corp. No. 3 Black, SE SE SW sec. 21-24-37. T.D. 3,230 ft.; set 7-in. csg.
Shell Pet. Corp. and Devonian Oil Co. No. 3 Christmas, C SW NE sec. 21-22-36. T.D. 3,830 ft.; to deepen.
Shell Pet. Corp. No. 2 Rinewalt, NW sec. 4-22-37. Drlg. 3,060 ft.
Shell Pet. Corp. No. 4-E State, C SW NW sec. 12-20-36. Drlg. 3,777 ft.
Skelly Oil Co. No. 5 J. B. Baker, C SE NW sec. 27-22-37. T.D. 3,620 ft.; testing.
Skelly Oil Co. No. 1 Combest, NW NW SE sec. 27-23-36. Coring 3,501 ft.
Skelly Oil Co. No. 1 E. T. Johns, SW sec. 21-24-37. Drk.
Skelly Oil Co. No. 2 Mon-State, C NE SE sec. 13-19-36. Drlg. 2,540 ft.
Skelly Oil Co. No. 3 G. W. Sims, C NW NE sec. 9-23-37. T.D. 3,642 ft.; cleaning out.
Skelly Oil Co. No. 1-C R. R. Sims, sec. 3-23-37. Drlg. 3,622 feet.
Skelly Oil Co. No. 1-E W. P. Sims, C NW NE sec. 10-23-37. T.D. 3,625 ft.; flow. 452 bbls. in 24 hours.
Skelly Oil Co. No. 2 W. P. Sims, C SE NE sec. 10-23-37. Drlg. 1,815 ft.

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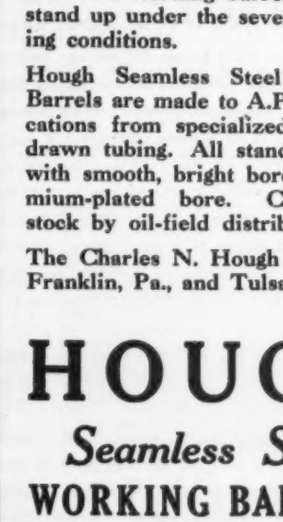

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Skelly Oil Co. No. 1 State H, C E half SW NW sec. 25-20-36. T.D. 3,740 ft.; set 7-in. csg.
Skelly Oil Co. No. 2 State H, C E half NW NW sec. 25-20-36. T.D. 3,740 ft.; set 7-in. csg.
Skelly Oil Co. No. 2 Sticher, C NW SW sec. 4-22-37. T.D. 3,721 ft.; pay 3,693 ft.; F. 53 B.O. in 6 hrs.
Stanolind O. & G. Co. No. 29-B Farnsworth, C SW NW sec. 7-26-37. T.D. 58 ft.; set 13-in. csg.
Stanolind O. & G. Co. No. 10-A Gilluly, SE SE NE sec. 24-20-36. Drlg. 3,096 ft.
Stanolind O. & G. Co. No. 11-A Gilluly, C SW NE sec. 24-20-36. Drlg. 3,485 ft.
Stanolind O. & G. Co. No. 12 Gilluly A, C NW NW sec. 24-20-36. T.D. 3,866 ft.; swabbing.
Stanolind O. & G. Co. No. 2-A Langlie, C NW SW sec. 9-25-37. T.D. 3,456 ft.; bailing.
Stanolind O. & G. Co. No. 1-A Hill, C NW SE sec. 6-21-37. Loc.
Stanolind O. & G. Co. No. 1-B Hill, NE sec. 6-21-37. Drlg. 3,494 ft.
Stanolind O. & G. Co. No. 2-B Langlie, C NW NW sec. 15-25-37. T.D. 3,458 ft.; P.B. 3,147 ft.; shut in.
Stanolind O. & G. Co. No. 2-A Myers, C SW SW sec. 15-24-37. Drlg.
Stanolind O. & G. Co. No. 3-A Myers, C SW SE sec. 22-24-37. Drlg. 3,280 ft.
Stanolind O. & G. Co. No. 1 State, C SE SE sec. 2-21-36. T.D. 3,854 ft.; F. 7½ B.O. in 24 hrs.; S.D.O.
Stanolind O. & G. Co. No. 1 Thompson, NE sec. 6-21-27. Cellar and pits.
W. H. Street No. 2 Wood, C SW NE sec. 22-22-37. T.D. 3,692 ft.; F. 44 B.O.P.D., tubing.
Sun Oil Co. No. 6 Akens, C NE SE sec. 3-21-36. T.D. 3,834 ft.; to acidize.
Texas Co. No. 1 American National, C NE NW sec. 18-19-37. Cellar and pits.
Texas Co. No. 2 Fristoe, NW NE NE sec. 3-25-37. Drlg. 835 ft.
Texas Co. No. 2-B State, SE sec. 16-23-36. T.D. 1,150 ft.; S.D., repairs.
Texas Co. No. 6-C State, NE sec. 19-20-37. Drlg. 1,600 ft.
Texas Co. No. 1-L State, C SW NE sec. 1-18-34. Drlg. 4,346 ft.
Texas Co. No. 2 Falvy, C NW NW sec. 8-22-37. Drlg. 3,319 ft.
Two States Oil Co. No. 1 Morris, SW SE SE sec. 21-18-38. Drlg. 1,750 ft.
Williams & Cockburn No. 3 Miller, C SW SW sec. 23-17-32. T.D. 3,880 ft.; swb. 20 B.O.P.D.

Eddy County

F. E. Baker No. 1 Eddy, NE sec. 12-22-27. Drlg. 135 ft.
Barnett Oil Dev. Co. No. 1 King Permit, C NW SE sec. 23-26-30. Rigged up and shut down.
Fred Brainerd No. 2 Brainerd, sec. 5-18-27. T.D. 1,824 ft.; 1,300 ft. fluid in hole; to pump.
Ed Bryant No. 1 Stebbins, C NE SW sec. 19-20-29. T.D. 1,000 ft.; S.D.O.
Carper Drlg. Co. No. 2 Gissler SW SE NW sec. 23-17-30. Drlg. 3,780 ft.
Cities Service Oil Co. No. 1 State, CSL SW SE sec. 16-17-30. T.D. 3,287 ft.; swb. 65 B.O.P.D.; testing.
Continental Oil Co. No. 1 Etz, C NW NE sec. 24-16-30. T.D. 3,745 ft.; P.B. 3,725 ft.; testing.
Danciger O. & R. Co. No. 3 Turner, SW NE SW sec. 18-17-31. Drlg. 2,308 ft.
Emperor Oil Co. No. 3 Puckett, C NE NW sec. 24-17-31. T.D. 3,840 ft.; S.D.O.
Etz Bros. No. 4 State, C S½ SE SE sec. 16-17-30. T.D. 480 ft.; W.O.C.
Finley & Cherry No. 1 Buchley, C NW NW sec. 28-16-31. Wildcat; drlg. 2,375 ft.
Flint Prod. Co. No. 1-B State, SE sec. 20-17-30. Drlg. 3,800 ft.
Franklin Pet. Corp. No. 1 McIntyre, NE NW SW sec. 20-17-30. Drlg. 720 ft.
C. J. Frederick No. 1 Reed, C NE SW sec. 28-24-28. T.D. 620 ft.; S.D.O.
F. W. & Y. Oil Co. No. 6-A Gissler, NE sec. 23-17-30. T.D. 2,950 ft.; set 6⅝-in. 2,942 ft.
F. W. & Y. Oil Co. No. 7-A Gissler, NE sec. 23-17-30. T.D. 2,950 ft.; set 6⅝-in. csg.
F. W. & Y. Oil Co. No. 1-B Gissler, SW sec. 14-17-30. Loc.
F. W. & Y. Oil Co. No. 3 Jackson, C NW SE sec. 13-17-30. T.D. 2,953 ft.; fishing.
Geo. F. Getty, Inc., No. 1-E State, NE SW SW sec. 16-17-31. T.D. 570 ft.; running csg.
Grayburg Oil Co. No. 8 Burch, SE SE NW sec. 19-17-30. Drlg. 2,965 ft.
Grayburg Oil Co. No. 9 Burch, SW NE NE sec. 19-17-30. Drlg. 2,027 ft.
Grayburg Oil Co. No. 4 Keely, SE sec. 24-17-39. Loc.
M. A. Grisham No. 1 Chaytor, NE sec. 10-24-26. S.D. 70 ft.
R. L. Holcomb No. 1 State, NW sec. 22-17-28. T.D. 455 ft.; S.D.
Woodworth Hawkins No. 1 Mack, C SW SW sec. 20-24-27. T.D. 380 ft.; junked hole; drlg. 40 ft. in new hole.
C. F. Ingram No. 1 Page, NE NE SW sec. 15-21-28. T.D. 1,140 ft.; S.D.
Nash-Windfohr & Brown No. 4-A Jackson, NE sec. 13-17-30. T.D. 3,451 ft.; cleaning out.
Nash-Windfohr & Brown No. 5-A Jackson, NE sec. 13-17-30. Drlg. 2,930 ft.
Nash-Windfohr & Brown No. 6-A Jackson, SE sec. 13-17-30. Drlg. 2,350 ft.
Nash-Windfohr & Brown No. 7-A Jackson, SE sec. 13-17-30. Drlg. 2,600 ft.
Nash-Windfohr & Brown No. 2-B Stevens, NW sec. 13-17-30. Rig.
W. A. Nichols No. 1 Johnson, NE sec. 35-16-21. Wildcat; T.D. 3,697 ft.; P. 20 B.O.P.D.; top sand 3,690 ft.
Premier Pet. Corp No. 1-E Parke, sec. 22-17-20. T.D. 3,423 ft.; F. 170 B.O. in 12 hrs.
Repollo Oil Co. No. 2-D McIntyre, NW NE SW sec. 20-17-30. T.D. 3,280 ft.; fishing.
Repollo Oil Co. No. 3-D McIntyre, SE cor. sec. 17-17-30. Loc.
Repollo Oil Co. No. 1-A Parke, NW NE NE sec. 22-17-30. Cellar and pits.
Repollo Oil Co. No. 2 West, SW SE SE sec. 9-17-31. R.U.M.
Paul Sargent No. 1 State, NE sec. 16-17-31. T.D. 3,749 ft.; P.B. 3,745 ft.; testing.
R. A. Shugart No. 1 Coulthard, C NW SW sec. 35-18-31. T.D. 3,447 ft.; 2,400 ft. oil in hole; S. 22½ B.O.
W. O. Snyder No. 1 Pecos Irrigation, C NE SE sec. 15-25-28. Drlg. 1,710 ft.
Weiner & McDonald No. 1 Kerr, C SE NW sec. 3-24-29. T.D. 3,125 ft.
Western Gas Co. No. 1 Cagle, C NW NW sec. 8-26-30. Drlg. 3,460 ft.

Chaves County

English & Hamon No. 11 Billingslea, SE sec. 9-15-29. T.D. 3,545 ft.; preparing to deepen.
E. J. Fisher No. 1 Etz Permit, NE sec. 23-7s-26. R.U. Machine.
Mathieson et al No. 1 Cole, C NE NW sec. 19-15-27. T.D. 825 ft.; S.D., repairs.

Curry County

Bond & Harrison No. 1 Hart Ranch, C NW SE sec. 13-2n-31. Drlg. 3,242 ft.

De Baca County

Land Owners Oil Co. No. 1 McAdoo, SW cor. sec. 16-1s-27e. Old well preparing to deepen from 5,860 feet.

Dona Ana County

Juels C. Bertrand No. 1 Casad Permit, sec. 24-26-5e. T.D. 47 ft.; S.D.O.

McKinley County

S. Dysart No. 1 Government, NE sec. 14-14-10w. T.D. 1,390 ft.; fsg.

Otero County

George Mulvey No. 1 State, SW cor. sec. 11-25-8. T.D. 263 ft.; S.D.
Fred Turner No. 1 Evans, NW NW SW sec. 22-25-12. O.W.D.D.; wildcat; T.D. 3,763 ft.; S.D.

Roosevelt County

C. S. Peterson and Conquistadores Oil Co. No. 1 Good, NW SE SE sec. 28-5s-30. Drlg. 360 ft.

NORTHWEST NEW MEXICO

Bernalillo County

Norins Realty Co., Inc., No. 2 North Albuquerque, NE SE NW sec. 19-11n-4e. S.D. 3,750 ft. for csg.

McKinley County

Guarantee Oil Co. No. 1 fee, NW NW NW sec. 31-20n-9w. Drlg. 300 ft.
S. Dysart et al No. 1 Bouton, CEL NW NE sec. 14-14n-10w. T.D. 1,390 ft.; re-ran 12½-in. to 1,320 ft. and S.D.

San Juan County

Continental Oil Co. No. 65 Rattlesnake, NE NW SE sec. 2-29n-19w. Drlg. sh. at 802 ft.
Jack Amenda No. 4 Hart, NW NE SW sec. 25-30n-12w. S.D. 2,048 ft.
Anna Oil Corp. No. 6 Govt., SW NE NE sec. 33-30n-11w. Drlg. below 1,000 ft.

Socorro County

Central New Mexico Oil Co. No. 1 Brown, SE NW sec. 16-3n-1e. S.D. 1,000 ft., C.D.; W.O. new boilers.

Valencia County

C. A. Brober et al No. 1 Fuqua, NE NE sec. 19-5n-3e. S.D. 900 ft.; to chge. to rotary.
Big Three Oil Co. No. 1 Dalles Townsite, SE SE NW sec. 5-6n-1e. T.D. 6,001 ft.; set whipstock at 5,640 ft.; W.O. equip.

COLORADO

Adams County

Oklahoma Oil Co. No. 1 Baxter, C SW sec. 2-3s-66w. S.D. 4,555 ft.
Glenridge Oil Corp. No. 1 Hills, SE SE SE sec. 27-3s-64w. T.D. 4,345 ft.; C.O. and prep. to cmt. caving hole.

Archuleta County

Prospect Oil Synd. No. 2 Lena M. Garnett, NW SW NE sec. 13-33n-2e. Drlg. 100 ft.; ran 40 ft. 15½-in. to carry through gravel.

Boulder County

J. B. Furstenberg No. 1 Foote, SE sec. 20-1n-70w. T.D. 2,480 ft.; rec. fish; C.O.
Boulder Prod. & Ref. Co. No. 11 Harlow Est., SE NE sec. 36-2n-71w. S.D.O. 765 ft.: dry in Muddy.

Garfield County

Roaring Fork Oil Co. No. 1 Patterson, C NE sec. 36-7s 88w. S.D. 570 ft.

Huerfano County

S. W. Pressey No. 1 Ojo, SW NE sec. 10-29s-69w. T.D. 3,550 ft.; cmtg. through gas flow.
S. W. Pressey No. 2 Alamo, C SW SE sec. 3-27n-68w. Spd.

Grand County

Interstate O. & R. Co. No. 1 Hinman, NE SE NW sec. 11-2n-81w. S.D. 2,230 ft.

Jackson County

Colorado Oil Ref. Co. No. 1 North Park Coal, NW NW sec. 18-9n-78w. T.D. 3,015 ft.; rng. 8¼-in. to 3,000 ft.

LaPlata County

N. Spatter No. 1 Bryce, SE SW SW sec. 31-33n-9w. S.D. 800 ft.

Lincoln County

The Gulf Oil Corp.'s important wildcat in Lincoln County, eastern Colorado, is drilling below 5,875 feet and is reaching an interesting depth. It had the top of the Dakota at 2,295 feet and, based on that formation, was running 280 feet high. The tentative top of the Pennsylvanian is 4,870 feet, indicating a thickening of 268 feet of the Permian beds as compared with its Galatea test.

Consolidated Smelting & Metals Corp. No. 1 Hancock, NE NE SW sec. 7-17s-52w. S.D. 2,860 ft.
Gulf Oil Corp. No. 1 Smith, C SW SE sec. 19-15s-53w. Drlg. in sh. and L. 5,875 ft.

Logan County

Transylvania Dev. Co. No. 1 Sheldon, NE sec. 3-10n-55w. Cellar; M.I. rot. (first report).

Mesa County

Midwest Drlg. & Dev. Co. No. 1 Callahan, NE NW SE sec. 30-8s-97w. Drlg. 2,565 ft.
Continental Oil Co. et al No. 1 Miller, SW SW NW sec. 36-8s-91w. Cmtd. 13⅜-in. at 630 ft. with 480 sacks and S.D. for winter.

Moffat County

Morapas Pet. Co. No. 1 Coles, SW SW SE sec. 1-3n-92w. T.D. 2,670 ft.; rng. 8¼-in.
Kerr-Lynn Drlg. Co. No. 1 Denise, C SE SE sec. 19-9n-99w. Drlg. 2,990 ft.

Montezuma County

McElmo Oil Co. No. 1 West, NE NW NW sec. 31-36n-17w. T.D. 3,830 ft.; rmg. at 3,790 ft. to set 4½-in. on bttm.; making about 3 B.P.D. 45-grav. oil; 830 ft. in Penn.

Morgan County

Swisher et al No. 1 Lunt, SE cor. sec. 3-4n-60w. T.D. 1,718 ft.; fsg. two strings tools and baller.

Park County

South Park Oil Co. No. 1 State, SE SE SW sec. 16-11s-75w. S.D. 5,705 ft. for winter.
South Park Oil Co. No. 1 Lemar, NE NE SE sec. 34-11s-75w. Drlg. 5,300 ft.

Pitkin County

Glenco Dev. Co. No. 1 Govt., NW cor. sec. 9-10s-89w. T.D. 1,040 ft.; redrlg. 12½-in. hole at 930 ft.

Pueblo County

Ed Solomon of Augusta, Kansas, is moving in standard rig for a 3,000-foot test in the Dry Basin district, 10 miles north of Fowler in E half section 11-21s-60w. Location is 4½ miles north of the Jones Point Oil Co.'s test drilled in 1923 in SE NW section 1-22s-60w, which lost the hole at 1,670 feet. It had the Timpas at 1,085 feet and top of the Dakota at 1,499 feet. It had a show of oil and gas in the Dakota at 1,505 feet.

The Solomon test probably will got to the top of the red beds.

Ed Solomon No. 1 Smith, E half sec. 11-21s-60w. M.I. rig; (first report).

Rio Blanco County

Buford Oil Co. No. 1 Govt., C SW SW sec. 16-1n-91w. Drlg. 2,090 ft. gr. Dolomite.
Texas Co. and California Co. No. 1 Unit, SW SE NW sec. 35-3n-94w. T.D. 6,211 ft.; cmtd. 9⅝-in. at 6,208 ft.; W.O.C.

WYOMING

Albany County

Murphy Oil Co. No. 11 Holst, NE SW NE sec. 13-17n-77w. Loc. Stdg.
Wyco Oil Co., Inc., No. 2-X Chappel, NE NE NW sec. 33-21n-76w. M.I.R.
Ohio Oil Co. No. 2 Griffin, SW SE SW sec. 2-21n-77w. Drlg. 663 ft.; 9⅝-in. at 195 ft.
Murphy Oil Co. No. 10 Holst, SE SE NE sec. 13-17n-77w. T.D. 3,487 ft.; completing.
Wyco Oil Co., Inc., No. 1 Chappel, C NE NW sec. 33-21n-76w. T.D. 765 ft.; swbg.; incr. in gas.
Murphy Oil Co. No. 2 Holst-Woolf, NE NW NW sec. 19-17n-76w. Drlg. 1,763 ft.

Big Horn County

Ohio Oil Co. No. 3 Sidon Canal, NW SW (Lot 40), sec. 24-56n-97w. Loc.; W.O. rig.
Joan Oil Co. No. 1 Howell, sec. 32-55n-97w (Lot 63). S.D. 1,150 ft.
Peay Oil Co. No. 1 Denio, Tr. 43-C, sec. 15-55n-97w. S.D. 3,930 ft.

Carbon County

The Ohio Oil Co. No. 14 Harrison & Cooper, NW NE NW section 2-19n-78w, Rock River field, was completed in the Sundance at a total depth of 3,210 feet for 400 bbls. per day. Sand was at 3,170-3,210 feet. This is a corrected number and location, formerly carried as No. 12 Harrison & Cooper, SE SW section 35-20-78. It is on the southeastern edge of the pool, a northeast offset to No. 7 Harrison & Cooper, a dry hole.

Ohio Oil Co. No. 13 Harrison & Cooper, SW SE SW sec. 35-20n-78w. M.I.R. Contr. to Rocky Mountain Drlg. Co.; (first report).
Superior Oil Co. No. 1 Christensen, NW NW NW sec. 7-12n-92w. Spdg.
Ohio Oil Co. No. 2 Union Pacific, SW SW SE sec. 20-21n-80w. Spdg.
Ohio Oil Co. No. 1 Brimmer, C NW NE sec. 32-27n-89w. Drlg. 550 ft.; cmtd. 8-in. at 210 ft.
Ohio Oil Co.-California Co. No. 4-B Kyle, C SW SW sec. 24-21n-79w. W.O. rig.
Ohio Oil Co.-California Co. No. 6 Union Pacific-Cronberg, C SW SE sec. 23-21n-79w. W.O. rig.
Sinclair-Wyoming Oil Co. No. 11 Wertz, SE NW NW sec. 7-26n-89w. T.D. 5,984 ft.; top Tensleep 5,974 ft.; cmtd. 7-in. 5,920 ft.; prep. to test.
Producers Oil Co. No. 1 CNL sec. 14-20s-88w. Drlg. 194 ft.
Ohio Oil Co.-California Co. No. 5 Cronberg-U. P., C NW NW sec. 25-21-79w. T.D. 5,765 ft.; top 2nd Sundance 5,741 ft.; swbg. after shot.
Ohio Oil Co.-California Co. No. 3-A Kyle, C SW NE sec. 26-21n-79w. T.D. 5,748 ft.; lower Sundance dry; P.B. to 5,733 ft.; swb. 6 B.P.H. O. and W. after shot.
Medicine Bow Oil Co. No. 1 Hintze-Govt., C NE SE sec. 18-22n-78w. S.D. 2,347 ft.

Converse County

D. D. Gray No. 1 Lane, SW SE SE sec. 22-32n-69w. M.I.M.
Kaufman & Quinlan Bros. No. 1 Lane, SE NW NE sec. 27-32n-69w. Loc. (first report).
John T. Coffee, Jr., No. 1 Mary Gaspar, NW NW SW sec. 25-32n-69w. Drlg. 163 ft.
Ainsworth Oil Co. No. 1 Marberger, NE SE NE sec. 34-32n-69w. Drlg. 350 ft.
Hall-Thornton et al No. 1 Roth, C NW SE sec. 13-32n-69w. Drlg. 450 ft.
Wyoming Southern Oil Co. No. 1 Lane, C NW NE sec. 27-32n-69w. Spd. and S.D.
Elbe Oil Ld. & Dev. Co. No. 1 Benham, NW NE sec. 5-31-70w. M.I.M.
Tom Carney No. 1 Beaver, SE SE SW sec. 28-35n-68w. M.I.M.
New Era Fuel Co. No. 1 Jones, SE SE SE sec. 21-32n-69w. Drlg. 250 ft.
Chadron-Osage Oil Co. No. 1 State, SW cor. sec. 16-32n-69w. T.D. 4,060 ft.; cmtd. 8¼-in. at 4,040 ft.; W.O.C.
Wyoming-Southern Oil Co. No. 3 Salisbury, NE NE SE sec. 27-32n-69w. T.D. 603 ft.; (C.D.) U.R. 6⅝-in. to set on bttm.

Fremont County

Stanolind O. & G. Co. No. 1 Govt., C SE SE sec. 3-33n-96w. Drlg. 3,470 ft. sdy. sh.
Sinclair Wyoming Oil Co. No. 2-C Muskrat, NE SW SW sec. 1-33n-92w. T.D. 8,112 ft.; P.B. to base Sundance at 6,200 ft.; W.O. shooter.

Consolidated Oil Properties No. 3, C SW SE sec. 16-1n-1w. Spdg.
H. Kenyon Burch No. 1 Enos, CEL NE NE sec. 28-3n-1w, S.D.O. 970 ft.; no shows.
Ben Stewart No. 1 Darnell, NE SE sec. 26-3n-1w. T.D. 500 ft.; set 8¼-in. at 475 ft.

Hot Springs County

Italo Pet. Corp. No. 1 Phebus-Govt., NW NW SW sec. 11-44n-98w. Drlg. 2,250 ft.
Oscar B. Grace No. 4 Govt., CNL SE NW sec. 21-43n-92w. T.D. 380 ft.; fsg. baller.

Lincoln County

H. M. Eller et al No. 4 Govt., SE NW SW sec. 32-19n-116w. T.D. 401 ft.; will test S.O. in lenticular sd. at 397-401 ft.
Place Oil Co. No. 1 Davis, SE SE SE sec. 9-26n-11w. T.D. 1,228 ft.; set pipe on top sat. zone at 1,212 ft.; tstg.

Natrona County

Stanolind O. & G. Co. No. 11 Wyo. Asso.-Tensleep, C NE NW sec. 35-40n-79w. T.D. 4,043 ft.; top Tensleep 3,825 ft.; prep. to set csg. at 4,037 ft.
Stanolind O. & G. Co. No. 29 Wyo. Asso-Tensleep, C SW SW sec. 26-40n-79w. Drlg. 3,086 ft.
General Pet. Corp. No. 1 Govt., C NW SE sec. 21-35n-77w. Drlg. 2,993 ft. in Mesa Verde; top 2,240 ft.
Western Producers, Inc., No. 1 Govt., NW SW SE sec. 5-39n-78w. Res.; drlg. 745 ft.

Niobrara County

The Argo Oil Co. No. 4 Ford, SW NW SE section 33-36n-65w, Lance Creek field, was completed in the Minnelusa at 5,392 feet, after plugging back from 6,016 feet, for 173 bbls. per day. It is located in an area which shows evidence of faulting and possibly a saddle between two highs. It is on the eastern edge of the Sundance pool and west of Minnelusa sand production. The Minnelusa was at 5,331-64 feet. Sundance at 4,042-4,118 feet was dry. Top of the Madison was at 6,002 feet. Elevation 4,451 feet.

The Continental Oil Co. No. 1 Leach, several miles to the northeast, became a mystery well this week when no reports were released on depth or formations. It is coring below 5,755 feet. An unconfirmed rumor says saturation was found in cores from the Minnelusa.

Ohio Oil Co. No. 2 Cash OPC-5, C NW NE sec. 4-35n-65w. Cellar; (first report).
Continental Oil Co. No. 6-B Schuricht, SW SW SE sec. 6-35n-65w. Rng. rig.
J. M. Huber Corp. No. 1 H. & M., NE NE NE sec. 8-35n-65w. W.O. rig.

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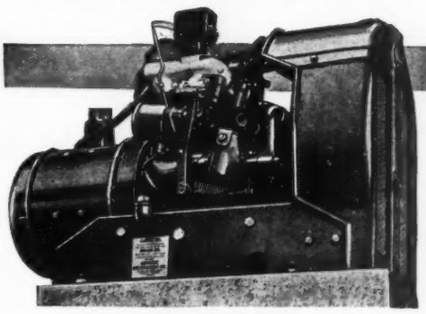

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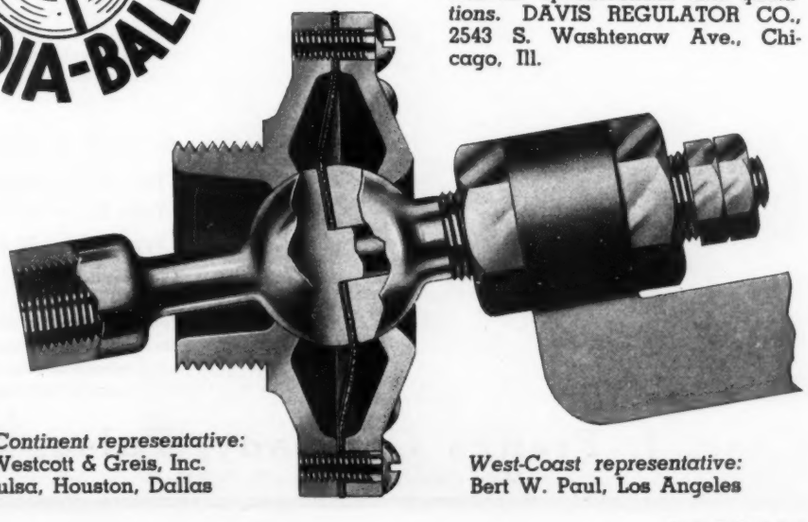

Mid-Continent representative: Westcott & Greis, Inc. Tulsa, Houston, Dallas

West-Coast representative: Bert W. Paul, Los Angeles

J. M. Huber Corp. No. 1 Joss, NE SE NW sec. 6-35n-65w. T.D. 4,096 ft.; O.W.D.D.; M.I.R.
Ohio Oil Co. No. 9 Putnam, C NE NW sec. 4-35n-65w. T.D. 4,059 ft. in sd.; cmtd. 7-in. at 4,029 ft.; drld. plug and tstg.
Lewis Goekel No. 1, NE SE NW sec. 31-35n-62e. Resumed drlg. 1,550 ft.
J. M. Huber Corp. No. 3 Joss, NE NE SW sec. 6-35n-65w. Drlg. 3,152 ft.
Continental Oil Co. No. 3 Apex-1, SE SE NE sec. 34-36n-65w. Cg. 5,420 ft.
W. A. Maupin et al No. 1 Berggren, NW sec. 23-35n-63w. Drlg. 180 ft.
J. M. Huber Corp. No. 1-A Lamb, NE SE SW sec. 27-36n-65w. Cmtd. 7-in. at unreported depth.
Continental Oil Co. No. 5-B Schuricht, C SW SW sec. 5-35n-65w. T.D. 5,203 ft.; cmtd. 7-in. at 5,198 ft.; W.O.C.; core showed sat. in Minnelusa.
Ohio Oil Co. No. 2 Leo-O.P.C., NE NE SE sec. 35-36n-65w. R.U.R.
Ohio Oil Co. No. 1 Leo-O.P.C.-7, NW NW SE sec. 35-36n-65w. T.D. 5,641 ft.; to test on pump.
Continental Oil Co. No. 1 Leach, SW NE NE sec. 29-36n-64w. Cg. below 5,755 ft.
Continental Oil Co. No. 8 Otto Rohlff, SW SW SE sec. 31-36n-65w. Cg. 5,462 ft. in Minnelusa.
MacKinnie Oil & Dev. Co. No. 2 Thompson, NW NW NE sec. 7-35n-65w. T.D. 4,064 ft.; C.O. at 1,580 ft.

Park County

Resolute Oil Co. No. 1 Northern Pacific, C NE NW sec. 21-57n-101w. Drlg. 7,310 ft.
Resolute Oil Co. No. 1 Govt., C NE NE sec. 20-57n-101w. Drlg. 8,622 ft.; 12 ft. in second Wall Creek; cores sat.

Platte County

Dividend O. & R. Co., Inc., No. 1 CSL NW SW sec. 17-24n-66. Drlg. 2,415 ft.; C.D.

Sublette County

Texas Co. No. 4-I, SW NE SW sec. 27-27n-113w. Spdg. 58 ft. (Cor. loc.)

Sweetwater County

Mountain Fuel Supply Co. No. 1 Hay, NE SE NW sec. 2-19n-110w. Spdg. 71 ft.
Italo Pet. Corp. No. 1 Govt., SW SW SW sec. 36-13n-95w. S.D. 610 ft.
Sinclair-Wyoming Oil Co. No. 77, SE NE NE sec. 10-26n-90w. Drlg. 2,445 ft. in r.b.; top 2,145 ft.; sat. cores from Sundance, top 1,923 ft.
Mountain Fuel Supply Co. No. 1 Union Pacific, C SW SE sec. 13-17n-104w. Cmtd. 4½-in. at 3,330 ft.
Mountain Fuel Supply Co. No. 1 Williams, C NE NE sec. 5-12n-95w. Drlg. 5,429 ft.
Mountain Fuel Supply Co. No. 1 Union Pacific, C SE NE sec. 29-15n-104w, S. of Baxter Basin. Loc.

Uinta County

E. A. Ottman et al No. 1 Govt., C SE NW sec. 26-14n-110w. Drlg. 1,110 ft.

Weston County

Osage drilling operations are being renewed following assurances of an increased outlet through increased capacity of the Consumers Oil & Refining Co.'s Newcastle plant. The Osage Trust Co. is starting work on three wells. Two of these are inside locations near the C S half section 14-46n-64w to be drilled to the Muddy and the third in section 22 is to go to the Sundance and will be prepared to deepen to the Minnelusa. Hugh Updike announced a location near the C NE section 22-46n-64w. Federal Oil Co. has material on the ground at a location in CNL SE SE section 15-46n-64w. Bradley-Manewal Oil Co. has rig on location for No. 7 in CWL NE NE section 20-46-63.

Osage Trust Co. No. 5, SE NW NE section 22-46n-64w. Loc. Sundance test; (first report).
Bradley-Manewal Oil Co. No. 7, CWL NE NE sec. 20 46n-63w. R.O.G.; (first report).
Federal Oil Co. No. 9, CNL SE SE sec. 15-46n-64w. R.O.G.; (first report).
Chas. Goodell et al No. 1 State, C NE NE sec. 23-44n-63w Rdy. to spd.
John Brorphy No. 1 George, SW SE NW sec. 26-48n-64w. Drlg. 1,850 ft.; top Minnelusa 1,384 ft.
Sisty et al No. 1 Carmine, SE SW sec. 31-44n-62w. Drlg. dark sh. 650 ft.
Le Faivre Oil Synd. No. 1 Martin, NW NW SW sec. 29-45n-68w. Drlg. 2,550 ft.; will U.R. 10-in. at 2,130 ft. for wtr. S.O.
Giles & Proutt No. 1 Govt., CEL SW NE sec. 29-45n-61w. Spdg. 30 ft.

MONTANA

The unexpected cut in prices of northern Montana crude was announced this week effective as of October 25. The Ohio Oil Co. reduced its posted price for Kevin-Sunburst crude from $1.20 to $1.05. The higher price had been in effect since January 28. The International Pipe Line Co. made a reduction of 11 cents for Cut Bank crude.

Big Horn County

E. L. Dana No. 1 Hardy, SW NW sec. 22-9s-35e. Drlg. 700 ft. in Eagle (Shannon) sd.; S.O. and G.

Carbon County

R. C. Tarrant No. 2 Heare, NW SE NW sec. 14-6s-10e. Drlg. 195 ft.; set 15½-in.
Miracle Oil Co. No. 2, CWL NE SE sec. 3-6s-23e. Cmtd. 6¼-in. at 1,568 ft.; W.O.C.
Ohio Oil Co. No. 16 Kirt, C SE SE sec. 4-7s-21e. T.D. 5,976 ft.; dry in Lakota; P.B. to 8⅝-in. at 4,950 ft.; W.O. perforator.
Geo. Muth et al No. 1, CSL SE SE sec. 23-6s-23e. S.D. indef. at 1,500 ft.
Henderson Prod. Co. No. 1-H-11 Elk 11, SE SE NW sec. 35-9s-23e. S.D. 1,626 ft. for 8¼-in.; top Frontier 1,608 ft.; small S.O.
Shaw-Wa Pet. Co. No. 1 Govt., SW SW NE sec. 35-9s-23e. Drlg. 350 ft. in 12½-in. hole.

Choteau County

Security Pet. Co. No. 1 Johnson, NE sec. 23-26n-3e. S.D. 1,690 ft.; (C.D.)

Cascade County

C. Leonard Smith No. 1-A Smith-Schwingle, NE NE SW sec. 14-22n-2e. T.D. 750 ft.; fsg. tools.

Daniels County

White Tail O. & G. Co. No. 2 Wiley, NW NW NW sec. 10-36n-50e. Drlg. 1,498 ft.

Fallon County

Johnson-Burke No. 1 Govt., SE NE SE sec. 6-8n-79e. Drlg. 1,200 ft.

Fergus County

Lewistown Oil Co. No. 1 Parks, C NE NE sec. 13-15n-18e. S.D. 350 ft.
Sam Phillips No. 1 Brakke, NW SE SW sec. 14-15n-19e. Drlg. 426 ft.
White Top O. & G. Co. No. 1 Govt., C NE SW sec. 35-14n-19e. S.D. 900 ft.

Glacier County

There was one completion and no new locations in the Cut Bank field. The Glacier Production Co. No. 3 Coburn, NE NE NW section 8-33n-5w, had 800 feet of oil in the hole at 2,821 feet, but it has not been tested. The Cut Bank sand was at 2,785-2,821 feet. The Sunburst at 2,725-55 feet had a slight show at 2,750-55 feet.

A. B. Cobb No. 1 State, C NE NE sec. 30-37n-4w. Drlg. 2,110 ft.
Texas Co. No. 8 Tribal-122, CEL SW SE sec. 6-32n-5w. Drlg. 2,740 ft.
B. V. Hole No. 3 All.-124, SE SW SE sec. 1-32n-6w. Drlg. 2,425 ft.
Drumheller Oil Trust No. 1 fee, C NE SW sec. 17-34n-6w. Drlg. 3,140 ft.
A. R. Pardee No. 1 Anderson, C SE SW sec. 31-32n-5w. S.D. 2,900 ft.

Judith Basin County

Fletcher E. Hunt No. 3, NW SE NE sec. 30-14n-15e. Drlg. 1,750 ft.

Lewis and Clark County

Lewis & Clark Oil Synd. No. 1 Lewis & Clark, NW NW SW sec. 11-18n-5w. Loc.; to go to 1,900 ft.
Lewis & Clark Oil Synd. No. 1 Pathfinder, CNL NW SE sec. 29-18n-4w. Loc.
Lewis & Clark Oil Synd. No. 1 Sacajawea, SE NE NE sec. 5-17n-4w. Loc.; prob. not drill this year.

Park County

Ben W. Ryan et al No. 1 Burgess, SE SW NW sec. 28-2s-11e. T.D. 1,012 ft.; C.D.

Petroleum County

O. B. Canfield No. 2 Govt., SE SE NE sec. 21-17n-24e. Drlg. 750 ft.; set 5⅞-in. for W.S.O.

Roosevelt County

John W. Schmidt et al No. 1 Freu, NW NW NE sec. 21-28n-50w. Drlg. 1,340 ft.

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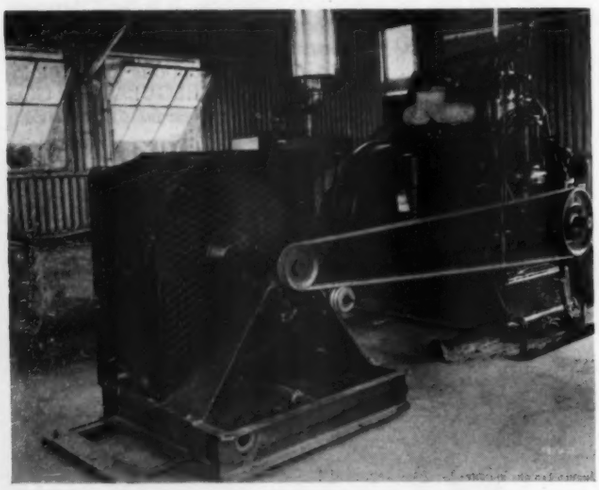

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Two wells were completed in the Kevin-Sunburst field. There was one new operation. A number of

Toole County

drilling wells are shut down on account of market conditions.

William Fulton No. 2 Thompson, SW SE NW section 28-35n-3e, swabbed 18 bbls. on the first test from the contact at 1,699-1,703 feet and 10 bbls. on the second test. It will not be acidized until spring.

McCurdy No. 1 Hollowell, C SE SW section 1-35n-3w, swabbed 50 bbls. per day from the Sunburst at 1,550-65 feet after plugging back to 1,550 feet. It was not acidized.

The Model Oils, Inc., No. 1 Fey, C NE SW section 5-37n-3e, on the Anaconda structure near the Canadian boundary, was plugged and abandoned at 2,940 feet. It had a small show of oil in the Sunburst sand at 2,879-80 feet. The contact was topped at 2,930 feet.

Ohio Oil Co. No. 2 Sunburst, C NE NE sec. 12-32n-2w. Drlg. 150 ft.; (first report).
Hannah-Porter Co. No. 2 Benjamin, CWL SE SW sec. 18-33n-1w. Spdg. 80 ft.
56 Pet. Co. No. 1 Davidson, SE SE NW sec. 26-35n-4w. Drlg. 1,250 ft.
New Era Fuel Co. No. 2 Goeddertz, CWL SE SW sec. 12-35n-3w. Drlg. 1,150 ft.
Welch Bros. No. 2 Ward, SW SE NE sec. 29-35n-3w. Drlg. 700 ft.
Wm. McKnight No. 3 Gunderson, NE NE NW sec. 19-35n-2w. T.D. 1,604 ft.; contact. 1,570 ft.; acid. 500 gals.; not tstd.
Big West Oil Co. No. 6 McDonald, SW SE SW sec. 19-35n-2w. T.D. 1,516 ft.; contact. 1,508 ft.; will acid.
Rice Oil Co. No. 2 Larson, SW NW NW sec. 18-35n-2w. T.D. 1,638 ft.; contact 1,600 ft.; 1 bailer oil overnight; will acid.
Plotke & Rader No. 11 Fryberger, NW SE SE sec. 29-35n-3w. T.D. 1,500 ft.; rig burned down.
Hamilton & Hamilton No. 4 Reeg, SE SW SE sec. 14-35n-2w. S.D. 450 ft.
Vander Pas & Montgomery No. 1 Thumm, NW SW NW sec 33-35n-3w. T.D. 1,710 ft.; contact 1,695 ft.; stdg.
Guy Smith No. 1 Govt., C NE SE sec. 35-36n-3w. Spd. 10 ft. and S.D.
C. T. Olen No. 7 Engemoen, C NW NW sec. 14-35n-2w. T.D. 1,607 ft.; contact 1,591 ft.
C. L. Tomlinson No. 1 Davidson, NW NE SE sec. 28-35n-3w. T.D. 1,500 ft.; rng. 7-in. to drill by bit.
E. O. Reickhoff No. 3 Baum, SW SW SE sec. 3-35n-3w. S.D. 10 ft.
California Co. No. 7 Neumann, NW NW NE sec. 23-35n-2w. T.D. 1,525 ft.; stdg.
Bryant Bros. No. 1 Lashbaugh, NE SW NW sec. 34-25n-2w. T.D. 850 ft.; R.U. heavier mach. to resume.

Outside Kevin-Sunburst

Montana Gas Corp. No. 2 Clark, C SE SW sec. 24-37n-1w. Drlg. 2,000 ft.

Yellowstone County

Riverton Oil Co. No. 1 Fox, CEL NW NE sec. 14-2n-23e. T.D. 1,210 ft.; cmtd. 8¼-in. 1,209 ft.; W.O.C.
Broadview Dome Oil Co. No. 1, NE NE SW sec. 18-3n-23e. Drlg. 3,141 ft. in Sundance; good S.G.
Lauriel Oil Co. No. 1, C NW SW sec. 7-2s-24e. S.D. 150 ft.

UTAH

Daggett County

Mountain Fuel Supply Co. No. 1 Smith, C SW NE sec 20-3n-24e. Drlg. 5,438 ft.
Mountain Fuel Supply Co. No. 3-B Murphy, NW NW SW sec. 23-3n-24e. Bldg. rig; (first report).

Grand County

Utah Southern Oil Co. No. 1 Hyde, SE NW NW sec. 33-22s-22e. S.D. 6,715 ft.; M.I. heavier rotary equip.
Columbia Crude Corp. No. 1 Rath, NW SW SE sec. 12-25s-20e. T.D. 2,265 ft.; prep to resume to go to 3,000 ft.
Cane Creek Oil Co. No. 1 Govt., NW SW sec. 31-26n-21e. S.D. 400 ft.

NEBRASKA

Sioux County

J. M. Huber Corp. and United Producers, Inc., No. 1 Morgan, C SW SW sec. 32-35n-56e. S.D. 3,257 ft.; r.b.

Jefferson County

L. R. Page et al No. 1 Bonham, C SE SE sec. 1-1n-1e. Drlg. 2,300 ft.

NORTH DAKOTA

Williams County

California Co. No. 1 Kamp, C NW NE sec. 3-154n-96w. Res. at 80 ft. after R.U.R.

Drilling in Brunei

Off-shore drilling is under way by the Royal-Dutch Shell group operating in Brunei, according to a report from the United States Trade Commissioner at Singapore. At the start of the current year there were 53 producing wells in Brunei and this total has been increased by about 12 or 15 completions since January, including one or two off-shore wells, the deepest of which was carried to 4,655 feet.

Brunei production is moved by pipe line to the Dutch Shell refinery in Sarawak. Since January, two new pumping stations have been installed on the line to facilitate crude deliveries. During all of 1936 the crude oil exported from Brunei to Sarawak had a value of $2,975,103.

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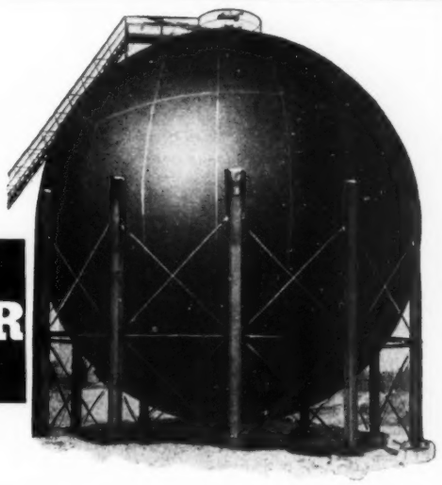

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East and East Central Texas

By L. E. BREDBERG

SIXTY-FOUR NEW LOCATIONS STAKED IN EAST TEXAS FIELD

DALLAS, Tex., Nov. 8.—The second Opelika test of the Tide Water Associated Oil Co., Seaboard Oil Corp. and Humble Oil & Refining Co. on the McElreath and Suggett lands, in the W. P. Wyche Survey, northeastern Henderson County, was tested in the past week and showed the same high gas volume as in the previous week.

It was plugged back from total depth of 9,320 to 9,255 feet, and packer set at 8,810 feet to make the drill stem test. It was opened 40 minutes, with three-eighth inch choke on top and bottom of stem. The first test showed 510 feet of the drill pipe dry and the next 98 feet mud, with no showing of oil. The well started to blow and was permitted to do so for 17 minutes, with the stem out of the hole. Pressure at the bottom of the hole showed 4,700 pounds. The gas was dry. The well is now shut in, but the casing will probably be gun-perforated higher up to test upper showings.

The deep test of the Humble Oil & Refining Co. and Gulf Oil Corp. on the east flank of the Gregg County portion of the East Texas field, about 2½ miles southeast of Longview, on the E. Robertson lands, in the M. Mann Survey, passed up the porous streaks logged at 6,551-68 feet, 6,562 and 6,588 feet, and the 500,000 feet of gas in the Glen Rose and is now drilling ahead at 6,825 feet to test the entire Trinity series. If it fails to pick up more encouraging formations it will probably be plugged back, and thorough tests made of the upper formations, where formation tests showed porosity. This is an exceptionally important test due to its location in regard to the East Texas field, which produces from the Woodbine horizon.

North of the East Texas field, in Upshur County, on a structure considered separate from that field, John Messenger and others are drilling a wildcat on the W. R. Thornton lands, in the P. Maulding Survey. It is about 1½ miles northwest of A. Baggett No. 1 Rash, a lone producer, which is considered to be on a separate and lower structure than the East Texas field structure. J. K. Wadley holds a large amount of acreage surrounding this new test. Wadley drilled a number of tests in the Jamestown area, north of the field, in Upshur County.

Bowie County Test

Four and a half miles northwest of Texarkana, in Bowie County, King Oil Corp. is digging pits for a wildcat on the W. W. Ames farm, in the J. A. Tolbott Survey. This is in the northeastern corner of the state.

Abandonments

S. Hunt and others No. 1 Dillard, located in the H. Jeffries Survey, 9 miles southwest of Mabank, in the northwestern corner of Henderson County, has been abandoned at a total depth of 6,503 feet. Elevation is 361 feet. It logged the Paluxy at 4,689 feet.

Three miles north of Sulphur Bluff and about 5 miles north of the Sulphur Bluff field in northern Hopkins County, Abbott and Rutland have junked and abandoned No. 1 Peyton, in the J. Burkham Survey. Total depth is 2,190 feet. Whether or not the operators will start another test in the area has not been signified.

EAST TEXAS FIELD

Sixty-four locations were staked in the East Texas field in the past week. There are 100 tests now drilling. Fifty-eight completions were reported during the same seven-day period. A number of each week's locations are shown to be those granted by the Railroad Commission as exception permits, or for wells other than those located 330 feet from property lines or 660 feet from other wells, in accordance with its own regulations for the field. These exception-permit wells necessitate the drilling of offsets when they are completed, readily showing why such a number of wells are being drilled in the field at this time.

This close spacing of wells, such as in the Kilgore townsite, where four wells had their derrick legs set against each other, will hasten the depletion of the field and the time when pressures will drop to the established 1,000-pound mark estimated by the petroleum engineers as the point when all wells will be on the pump in the field. With pressures dropping in the field around 12 pounds per month, it will not be many months until the 118.56 pounds above the 1,000 mark will be dissipated. At the same time, more salt water will be produced in the field to give the operators something else to worry about as the Fish and Game Commission is also having its troubles in preventing much of this water from finding its way into streams and rivers from which water is taken for irrigation purposes near the Gulf.

EAST CENTRAL TEXAS COMPLETIONS

Anderson County

Tide Water Associated No. 3-B Wills, 4,087 feet, 69 bbls. through 3/32-inch choke.

Franklin County

Byrd-Frost, Inc. No. 17 Phillips, 4,173-4,294 feet, 242 bbls. on pump. Dean Brothers No. 2 Bolin, 4,222-4,315 feet, 256 bbls. on pump; No. 3 Bolin, 4,235-4,320 feet, 100 bbls. on pump. Humble Oil & Refining Co. No. 7 Dawson, 4,220-4,318 feet, 187 bbls. on pump. Stroube and Stroube No. 5 Prince, 4,247-90 feet, 438 bbls. on pump.

Henderson County

S. Hunt and others No. 1 Dillard, dry and abandoned 6,503 feet, elevation 361 feet, 9 miles southwest of Mabank. Roeser & Pendleton, Inc. No. 7 Wathen, 4,096-4,106 feet, 50 bbls. in 11 hours through one-eighth inch choke.

Hopkins County

Abbott and Rutland No. 1 Peyton, junked and abandoned 2,190 feet, 3 miles north of Sulphur Bluff. W. Goldston and others No. 21 Smith, 4,497-4,524 feet, 17 bbls. per hour through one-quarter inch choke. Hager and others No. 1 Long, 4,465-4,504 feet, 122 bbls. in five hours through one-quarter inch choke.

Nacogdoches County

G. C. Collier No. 1-A A. T. Mast, dry and abandoned 5,834 feet, elevation 198 feet, 15 miles southwest of Nacogdoches.

Titus County

G. M. & W. Oil Co. No. 5 Cato, 4,152-4,320 feet, 70 bbls. per day on pump. Housh and Thompson No. 5 Hargrove, 4,175-4,265 feet, 508 bbls. on pump. Humble Oil & Refining Co. No. 8 Fry, 4,207-98 feet, 63 bbls. in eight hours on pump; No. 6 Galt, 4,220-95 feet, 335 bbls. on pump. Magnolia Petroleum Co. No. 6 Belcher, 4,224-4,315 feet, 310 bbls. on pump.

EAST TEXAS FIELD COMPLETIONS

Gregg County

Atlantic and Sun No. 15 Anderson, 3,471-3,510 feet, 70 bbls. per hour. F. H. E. Oil Co. No. 16 Christian, 3,621-54 feet, 20 bbls. in 30 minutes. Hamil and Smith No. 5 Everett Estate, 3,487-3,525 feet, 100 bbls. per hour. Humble Oil & Refining Co. No. 17 Killingsworth, 3,600-10 feet, 62 bbls. per hour. Kewanee Oil & Gas Co. No. 30 Hampton, 3,557-97 feet, 21 bbls. in 15 minutes. Magnolia Petroleum Co. No. 8 Castleberry, 3,599-3,617 feet, 25 bbls. in 15 minutes. O. W. R. Oil Co. No. 5-B Davis, 3,565-92 feet, 60 bbls. in 30 minutes. Rajo Oil Co. No. 12 Barrett, 3,634-43 feet, 45 bbls. per hour. Shell Petroleum Corp. No. 38 Moore, 3,549-55 feet, 30 bbls. in 25 minutes. Stanolind Oil & Gas Co. No. 14 Ingram, 3,496-3,585 feet, 40 bbls. per hour; No. 9 Rodden, 3,575-95 feet, 38 bbls. per hour; No. 10 Rodden, 3,553-65 feet, 41 bbls. per hour. Sun Oil Co. No. 6 Reppond, 3,656-92 feet, 25 bbls. in 30 minutes. E. H. Walker, Trustee No. 1 Buckley, 3,592-3,628 feet, 50 bbls. per hour. Everts Drilling Co. No. 8 Laird, 3,558-3,603 feet, 85 bbls. per hour. Halliburton Drilling Co. No. 13-B Lacey, 3,659-60 feet, 18 bbls. in 45 minutes. Hamil and Smith No. 3 Culp, 3,534-75 feet, 70 bbls. per hour; No. 3 Faircloth, 3,523-55 feet, 20 bbls. per hour. Humble Oil & Refining Co. No. 24 Knowles, 3,550-3,616 feet, 52 bbls. per hour. Jones and O'Brien No. 18 Hughey and Ross, 3,513-43 feet, 51 bbls. in 50 minutes; No. 19 Hughey and Ross, 3,518-48 feet, 60 bbls. per hour. W. B. Murphy, Receiver No. 3 Luce, 3,584-84½ feet, 45 bbls. per hour; No. 2 Luce, 3,577-77½ feet, 45 bbls. per hour. B. F. Phillips No. 4 Walker, 3,578-92 feet, 30 bbls. in 30 minutes. Potter Brothers No. 1 Bagwell, 3,535-55 feet, 20 bbls. in five hours. Selby and Lewis No. 16 Cole, 3,535-52 feet, 36 bbls. in 30 minutes. Sun Oil Co. No. 53 Cole, 3,520-74 feet, 59 bbls. per hour; No. 30 Lloyd, 3,679-80 feet, 63 bbls. per hour; No. 31 Lloyd, 3,663-64 feet, 49 bbls. per hour. Texas Co. No. 14 Davis, 3,520-30 feet, 60 bbls. per hour.

Rusk County

Meco Production Co. No. 11 fee, 3,694-95 feet, 20 bbls. in 35 minutes. Natural Petroleum Co. No. 5 Henderson, 3,546-80 feet, 6 bbls. per hour on pump. Navarro Oil Co. No. 25 Brightwell, 3,627-55 feet, 60 bbls. per hour. Ward Oil Co. No. 10 Beall, 3,697-98 feet, 49 bbls. in 80 minutes. DeArman and others No. 6 Arnold-Lacey, 3,658-67 feet, 168 bbls. in eight hours on swab. Gulf Oil Corp. No. 10-C Mayfield Co., 3,662-72 feet, 20 bbls. per hour. Humble Oil & Refining Co. No. 9 Barton, 3,744-54 feet, 60 bbls. per hour; No. 12 Dennis, 3,737-40 feet, 70 bbls. per hour; No. 15-B Holt, 3,740-48 feet, 80 bbls. per hour; No. 23-A Wheelis, 3,717-18 feet, 70 bbls. per hour. M. H. McMurray No. 18-A Blackwell, 3,664-69 feet, 50 bbls. in 30 minutes. Ohio Oil Co. No. 11 Kangerga, 3,615-28 feet, 48 bbls. per hour. O. Phillips No. 2 Alford, 3,576-3,689 feet, 20 bbls. in four hours on pump. Royal Petroleum Co. No. 2 Bradford, 3,564-3,606 feet, 23 bbls. in five hours. Stanolind and Pure No. 4 Lacey, 3,609-15 feet, 8 bbls. in two hours on pump. Sun Oil Co. No. 10-B Schuler, 3,625-68 feet, 20 bbls. per hour. Tide Water Associated No. 26 Pinkston, 3,760-86 feet, 15 bbls. in 15 minutes. Ward Oil Co. No. 16-A Finney, 3,670-3,707 feet, 54 bbls. in one and one-half hours.

Smith County

Texas Canadian Oil Co. No. 13 Jackson, 3,722-23 feet, 120 bbls. per hour.

Upshur County

J. T. Crotty No. 7 Webb, 3,692-95 feet, 60 bbls. per hour. Day & Co. No. 3 Victory, 3,577-80 feet, 20 bbls. in 20 minutes. Dean Brothers and Phillips No. 1-A Godfrey, 3,734-38 feet, 25 bbls. per hour. East Texas Drilling Co. No. 1 Phillips, abandoned 3,125 feet. Humble Oil & Refining Co. No. 14-B O'Byrne, 3,664-93 feet, 58 bbls. per hour. W. R. Nicholson No. 2 fee, 3,694-95 feet, 20 bbls. per hour. Petroleum Co. of Venezuela No. 15 Walker, 3,595-3,636 feet, 40 bbls. in 30 minutes. P. H. Pewitt No. 10 Williford, 3,644-45 feet, 25 bbls. per hour; No. 14 Williford, 3,363-75 feet, 21 bbls. in 45 minutes.

California Field Report

By L. P. STOCKMAN

WILMINGTON'S CLOSED AREA WILL BE OPENED THIS WEEK

LOS ANGELES, Calif., Nov. 8.—Drilling restrictions will be officially lifted in the Wilmington field within the next few days as ordinance No. 22 of the Long Beach Harbor Commission becomes effective November 11. Plans have been made to inaugurate an intensive drilling program as soon as the restrictions have been lifted and consequently we may expect to see the erection of at least 10 rigs before November 15. Roads to locations were completed several weeks ago and everything is in readiness. This section of the Wilmington field will be developed along conservative lines with not more than one well allowed to each acre. On this basis it appears quite probable that 100 new wells will be drilled within the next few months. During the current week five new wells were completed but none of them registered substantial production. Buckeye Union Oil Co. No. 1 Bill was brought in flowing 495 bbls. of clean 17.8-gravity oil per day from 3,600 feet and Brookline Oil Co. No. 1 Nix, drilled by Gus Pongratz, was completed pumping 284 bbls. of clean 17.2-gravity oil daily from 3,671 feet. No. 2 Banning of McDonald & Burns was brought in flowing 543 bbls. of clean 16.8-gravity oil per day from 3,625 feet. This well was finished with 703 feet of 8⅝-inch liner carrying perforations at 2,962-3,027 feet, 3,067-3,190 feet and at 3,269-3,625 feet and is flowing through a 20/64-inch bean. Neilsen, Dunwoody and associates have completed their No. 1 Wilmington flowing 280 bbls. of 16.4-gravity oil per day from 3,600 feet and Union Pacific Railroad Co., largest holder of undeveloped acreage in the Wilmington field, brought in No. 44 flowing 705 bbls. daily from 3,348 feet. The latter well was finished with 410 feet of 6⅝-inch liner carrying perforations at 2,959-3,245 feet and at 3,270-3,343 feet and shows a tubing pressure of 275 pounds and a casing pressure of 680 pounds.

Mount Poso

In the Mount Poso field Ring Oil Co. completed two new wells which showed an aggregate initial production of 622 bbls. No. 2 on the Bohen property in section 32-27-28 was finished pumping 252 bbls. of clean 15.8-gravity oil daily from 1,690 feet while the No. 3 Bohen was brought in pumping 370 bbls. of clean 15.9-gravity oil daily from 1,670 feet. Vanguard Oil Co. No. 8 Baker, in section 33-27-28, has been completed pumping 471 bbls. of clean 15.8-gravity oil per day from 1,719 feet after the hole had been finished with 30 feet of 5-inch liner including 25 feet of perforated. D. G. Vedder No. 3 B.N.B., in section 32-26-28, tanked 330 bbls. of clean 15.9-gravity oil during the initial 24 hours following completion at 1,752 feet, and present plans call for the starting of another well on the lease shortly. Sunset Oil Co. No. 5 Vedder, in section 28-26-28, was completed pumping 55 bbls. of 15.6-gravity oil per day from 1,604 feet after the hole had been finished with 105 feet of 5-inch liner including 82 feet of perforated.

El Segundo

Only one new well was completed in the El Segundo field of Los Angeles Basin during the current week but several other potential producers are nearing completion and should be finished within a short time. The new well chalked up this week was No. 1 Goodwin of Pacific Western Oil Co. brought in flowing 1,120 bbls. of clean 26.5-gravity oil and 600,000 feet of gas per day from 7,436 feet. Top of the Schist was logged at 7,435 feet and the hole was finished with 114 feet of 5-inch liner including 89 feet of perforated landed on bottom. This new producer is flowing through a 1¼-inch bean under a tubing pressure of 100 pounds and a casing pressure of 445 pounds. Wells scheduled for completion within another fortnight include Getty Oil Co. No. 1-A El Segundo, replacing No. 1 which blew out and was destroyed in addition to creating a bad mechanical problem in No. 1 Goodwin of Pacific Western Oil Co. mentioned above, and No. 8 Gough of Ohio Oil Co., No. 1 Howard of Richfield Oil Corp., Standard Oil Co. No. 4 Refinery and No. 5 Security of the Texas Co. Tide Water Associated Oil Co. No. 1 Leuzinger in the northeastern part of the field is getting rather deep at 7,510 feet and consequently has taken on a rather dubious outlook.

Lost Hills-Belridge

In the North Belridge field of Kern County Belridge Oil Co. completed No. 53 in section 26-27-20 flowing 3,820 bbls. of exceptionally clean 31.1-gravity oil and 2,330,000 feet of gas per day from the Wagonwheel zone of Eocene age at 8,410 feet. It is flowing through a 9/64-inch bean under a tubing pressure of 190 pounds and a casing pressure of 1,540 pounds and was finished with 396 feet of 4¾-inch liner including 355 feet of 250-mesh screen landed on bottom. Belridge Oil Co. is starting a well in section 27-27-20. The Texas Co. northwestern extension well, No. 1 Martin in section 22-27-20, is flowing 576 bbls. of 32.6-gravity oil per day through a 12/64-inch bean along with 550,000 feet of saturated natural gas. Tubing pressure is 1,700 pounds and casing pressure is 2,650 pounds. The company has started a second well on the Martin lease and Tide Water Associated Oil Co. and Belridge Oil Co. are making hole in offsets. Richfield Oil Corp. is rigging up No. 1-A Belridge in section 22-27-20 and will be making hole this week. In the Lost Hills field Standard Oil Co. is bailing No. 6 United following conclusion of drilling operations at 1,592 feet and has staked location for No. 7 United. The Texas Co. is rigging up pumping equipment in No. 2-27 Theta and Tide Water Associated Oil Co. is rigging up tools preparatory to deepening No. 10-E-3 Williamson now down 2,067 feet.

Kern County

Hogan Petroleum Co. has completed No. 4 Bankline-Symons in section 4-31-29 at Mountain View and this new well was brought in flowing 1,170 bbls. of clean 26.4-gravity oil and 1,000,000 feet of gas per day from 5,515 feet. In the same section the company is putting the finishing touches on No. 5 C.C.M.O.-Symons at 5,381 feet and should have it ready for a production test shortly. Petrol Production Co. has concluded drilling operations on No. 1 Earl Fruit in section 4-31-29 at 5,815 feet, but the well failed to respond with a natural flow. As a consequence pumping equipment is being rigged up. In the Round Mountain field of Kern County, Tampico Petroleum Co. has completed No. 4 Bond in section 17-28-29 pumping 412 bbls. of clean 16.8-gravity oil per day from 1,866 feet after the hole had been finished with 39 feet of 7-inch liner including 24 feet of 80-mesh screen. No. 3 Bond, a recent completion at 1,867 feet, is holding up in good shape as it is at present producing 351 bbls. of clean 16.8-gravity oil daily. In the Midway-Sunset field, Chanslor Canfield Midway Oil Co. has completed No. 44 in section 21-32-23 pumping 130 bbls. of 15.4-gravity oil per day from 2,305 feet. This new well was finished with 362 feet of 8⅝-inch liner including 357 feet of 140-mesh screen and a 10¾-inch water string cemented at 1,974 feet. The large penetration in the oil zone indicates that the company may expect long-lived production. Several potential producers are nearing completion in this field and consequently the completion list during the next few weeks should contain one or more producers in this field. Included in this group are Gibson Oil Co. No. 5 O'Brien, Hallmark Oil Co. No. 8 in section 25-12-24, National Oil Co. No. 30, Richfield Oil Corp. No. 14 Fellows and Standard Oil Co. No. 2-25-L in section 25-12-24. In the McKittrick field of Kern County Goforth & Bradfield have completed No. 7 in section 18-30-22 pumping 30 bbls. of 16.3-gravity oil per day from 793 feet after the hole had been drilled down to 862 feet and plugged back to the completion depth because of bottom water. Out in the Kern Front section of the Kern River field Republic Petroleum Co. has completed No. 14 Strassburger pumping 278 bbls. of clean 14.6-gravity oil daily from 1,986 feet. This new well, which showed a larger initial than expected, was finished with 245 feet of 8⅝-inch liner including 226 feet of 100-mesh screen and 1,680 feet of 2½-inch tubing.

Coastal Area

In the Rincon field of the Coastal area Chanslor Canfield Midway Oil Co. has completed No. 17-B Hob-

TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	October 28		October 21			
	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Intercoastal-domestic:						
Crude oil	.....	.....	.....	.....	129,788	.....
Diesel and gas oil	.....	.....	.....	.....	176,726	151,541
Gasoline	123,408	17,630	91,731	13,104	3,666,922	5,295,506
Kerosene	.....	.....	.....	.....	328,907	968,157
Foreign exports:						
Crude oil	709,531	101,362	302,851	43,264	12,986,105	7,800,191
Fuel oil	254,403	36,343	339,482	48,497	12,077,560	8,714,202
Diesel and gas oil	82,757	11,822	232,393	31,770	6,400,773	4,834,137
Gasoline	9,666	1,381	104,136	14,891	6,649,953	6,377,190
Kerosene	.....	.....	91,981	13,140	1,967,922	1,313,061
Lubricants	.....	.....	.....	.....	12,984	.....
Other unfinished oil	.....	.....	.....	.....	974,785	155,253
Coastwise-domestic:						
Crude oil	231,689	33,098	314,893	44,985	4,728,577	5,964,560
Fuel oil	408,340	58,334	331,687	47,384	12,994,712	8,824,179
Diesel and gas oil	20,647	2,950	90,451	12,922	1,906,256	977,215
Gasoline	313,137	44,734	431,571	61,653	13,157,492	10,286,663
Kerosene	32,389	4,627	2,165	309	351,953	145,416

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic:						
Diesel and gas oil	.....	.....	69,398	9,914	222,330	142,472
Gasoline	.....	.....	.....	.....	25,778	285,959
Kerosene	.....	.....	.....	.....	72,750	.....
Asphalt	.....	.....	.....	.....	413,885	327,418
Lubricants	.....	.....	.....	.....	25,522	43,543
Foreign exports:						
Crude oil	123,822	17,689	248,278	35,468	2,831,674	2,721,912
Fuel oil	.....	.....	.....	.....	1,758,156	2,260,116
Diesel and gas oil	62,565	8,938	58,703	8,386	2,593,788	1,613,442
Gasoline	155,592	22,227	81,495	11,642	4,545,902	3,275,572
Kerosene	.....	.....	35,345	5,049	823,159	571,023
Lubricants	.....	.....	15,796	2,257	474,494	323,140
Other unfinished oil	.....	.....	.....	.....	.....	90,923
Coastwise-domestic:						
Fuel oil	120,211	17,173	78,059	11,151	5,399,360	5,371,217
Diesel and gas oil	69,803	9,972	50,177	7,168	1,206,501	579,776
Gasoline	136,714	19,531	183,835	26,262	4,619,523	4,275,607
Kerosene	69,506	9,929	.....	.....	319,938	175,284

STANDARD OIL CO. OF CALIFORNIA AND UNION OIL CO.

Crude oil prices at the well effective June 22, 1936

Gravity—	Signal Hill (Long Beach)	Seal Beach	Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda-Brea Canyon	Athens-Rosecrans	Dominguez	Elwood Terrace	Torrance	Richfield	Whittier E. Coyote (La Habra)	Montebello	W. Coyote Hills	Santa Fe Springs	Mountain View	Elk Hills Buena Vista Hills Midway-Sunset Lakeview Area	Lost Hills	Coalinga	Wheeler Ridge	Kettleman Hills	Santa Paula*	Orcutt*
14-14.9	$ 80	$ 79	$ 74	$ 78	$ 79	$ 80	$ 76	....	....	....	$ 80	$ 76	$ 76	$ 77	$ 78	....	....	$ 70	$ 70	$ 70	....	....	$ 70	....
15-15.9	80	79	74	78	79	80	76	....	....	....	80	76	76	77	78	....	....	70	70	70	....	....	70	....
16-16.9	80	79	74	78	79	80	76	....	....	....	80	76	76	77	78	....	....	70	70	70	....	....	70	$ 70
17-17.9	80	79	74	78	81	80	76	....	....	....	80	76	76	77	78	....	....	70	70	70	....	....	71	70
18-18.9	80	79	74	78	84	80	78	....	....	....	82	76	76	77	78	....	....	70	70	70	....	....	73	72
19-19.9	82	79	74	82	87	84	81	....	....	....	85	76	78	77	78	....	$ 70	74	74	71	$ 70	....	75	74
20-20.9	85	79	74	85	90	88	84	....	....	....	88	78	82	77	80	....	70	78	78	72	70	....	77	77
21-21.9	88	79	74	89	93	93	88	....	....	....	91	80	85	77	84	$ 78	73	82	82	74	70	....	79	80
22-22.9	92	82	74	92	96	98	92	....	....	....	93	84	89	79	88	78	77	87	86	78	72	....	82	83
23-23.9	95	86	77	96	99	1 02	96	$ 84	$ 79	....	96	88	93	82	92	78	80	92	90	82	76	....	85	86
24-24.9	99	91	80	1 00	1 02	1 06	99	88	81	....	99	91	96	85	96	82	84	97	94	86	79	....	87	88
25-25.9	1 03	95	82	1 03	1 05	1 11	1 03	93	83	....	1 02	95	....	89	99	86	88	1 01	98	90	83	....	90	91
26-26.9	1 06	1 00	85	1 07	1 09	1 16	1 06	98	86	....	1 05	98	....	92	1 03	90	91	1.06	1 02	....	....	....	92	93
27-27.9	1 10	1 05	88	1 11	1 12	....	1 10	1 03	88	....	....	1 02	....	96	1 06	95	95	1.10	1 06	....	....	....	95	....
28-28.9	1 14	1 10	90	1 14	1 15	....	1 14	1 07	90	....	....	1 06	....	99	1 10	99	99	1.15	1 10	....	....	....	97	....
29-29.9	1 17	1 15	93	1 18	1 18	F.O.B.	1 17	1 12	93	....	....	1 09	....	1 03	1 14	1.03	1 02	1 20	1 14	....	....	....	99	....
30-30.9	1 21	1.19	95	1 22	1 21	our	1 21	1 17	95	F.O.B.	....	....	....	1 07	1 17	1.08	1 06	1 25	1.18	....	....	....	1 01	....
31-31.9	....	....	....	....	1 24	Pipe	1 24	1 22	97	Ship	....	....	....	1 11	1 21	1.12	1 09	1 29	....	....	....	....	....	....
32-32.9	....	....	....	....	1 27	Line	1 27	1 27	1 00	....	....	....	....	1 14	1 25	1 16	1 13	1 34	....	....	....	....	....	....
33-33.9	....	....	....	....	....	....	....	1 32	....	$1 28	....	....	....	1 18	1 28	1.20	1 17	1.38	....	....	....	$1 19	....	....
34-34.9	....	....	....	....	....	....	....	1 37	....	1 32	....	....	....	1 22	1 32	1 25	1 20	....	....	....	....	1 23	....	....
35-35.9	....	....	....	....	....	....	....	1 42	....	1 35	....	....	....	1 25	....	1 29	....	....	....	....	....	1 27	....	....
36-36.9	....	....	....	....	....	....	....	1 46	....	1.39	....	....	....	1 29	....	1 33	....	....	....	....	....	1 31	....	....
37-37.9	....	....	....	....	....	....	....	1 51	....	1 43	....	....	....	1 32	....	1 37	....	....	....	....	....	1 35	....	....
38-38.9	....	....	....	....	....	....	....	1 56	....	....	....	....	....	1 36	....	1.42	....	....	....	....	....	1 39	....	....
39-39.9	....	....	....	....	....	....	....	1 61	....	....	....	....	....	1 40	....	....	....	....	....	....	....	1 43	....	....	....
40-40.9	....	....	....	....	....	....	....	1.66	....	....	....	....	....	1 43	....	....	....	....	....	....	....	....	....	....

Newhall, McKittrick, Kern River, Kern Front and Round Mountain, 70 cents for all grades. *Posted by Union Oil Co. Same company's Brea Canyon schedule stops at $1.14 for 28 degrees and over, and Belridge and Lost Hills schedule stops at $1.32 for 37 degrees and over. By Standard Oil Co., effective October 15: El Segundo, 14 to 18.9 degrees, 80 cents; 19-19.9, 82 cents; 20-20.9, 85 cents; 21-21.9, 88 cents; 22-22.9, 92 cents; 23-23.9, 95 cents; 24-24.9, 99 cents; 25-25.9, $1.03; 26-26.9, $1.06; 27-27.9, $1.10; 28-28.9, $1.14; 29-29.9, $1.17; 30-30.9, $1.21. Wilmington, 14 to 16.9, 75 cents; 17-17.9, 77 cents 18-18.9, 79 cents; from 19 degrees upward, prices same as Signal Hill.

son flowing 393 bbls. of relatively clean 30.8-gravity oil and 280,000 feet of gas per day from 4,242 feet and is making preparations to begin work on Nos. 18 and 19. This new well was finished with 522 feet of 6⅝-inch liner including 478 feet of perforated landed at 4,240 feet and is flowing through a 20/64-inch bean under a tubing pressure of 200 pounds and a casing pressure of 495 pounds. In the Shiells Canyon area of Ventura County, Petroleum Securities has completed No. 6 Home Ranch flowing 236 bbls. of 37.9-gravity oil and 2,900,000 feet of gas per day from 4,393 feet. This new well was finished with an 8⅝-inch combination string and it is flowing through a half-inch bean under a tubing pressure of 560 pounds and a casing pressure of 850 pounds. Drilling operations in the Santa Maria Valley district are showing a substantial increase and are expected to continue to register further gains. E. H. Moore, Inc., has assumed an aggressive drilling program since finding its Union Sugar property productive and during the current week staked two additional locations. Union Oil Co., discoverer of this field, has reduced drilling operations to a minimum, but has several new wells scheduled to be started within another few weeks. This field, which has a rated potential daily production of 25,000 bbls., is being severely curtailed as production has been averaging around 8,000 bbls. per day.

Central West Fields

(Continued from Page 236)

Joseph B. Mayer and others No. 2 John A. Rowan, rigging up.

Island district: South Penn Oil Co. No. 1 Mrs. Rena Brown, deep test, drilling at 2,508 feet in Mississippi lime.

Knobs district: J. C. Miller, Trustee No. 3 George Bryant, drilling deeper at 1,085 feet.

Henderson County

Niagara district: Mecca Oil Co. No. 21 C. M. Gish, 100 bbls. from Niagara sand 686-715 feet, shot with 90 quarts; No. 22 rigging up. H. Z. Clark No. 8 J. C. Wallace, 75 bbls., Niagara sand at 719-43 feet, shot with 90 quarts.

Breckinridge County

VanZant district: Kentucky Natural Gas Co. No. 4 Mack H. Brown, 70,000 feet of gas at 530 feet, Bethel sand 520-50 feet, total depth 555 feet, abandoned.

Webster County

Sebree district: I. B. Browning and others No. 6 J. R. Ramsey, deep test, drilling at 120 feet.

Slaughters district: Imperial Oil & Gas Co. No. 1 Archibald Estate, deep test, has resumed fishing after being shut down.

Union County

Boxville district: H. Z. Clark and others No. 3 Waller Young, estimated 20 bbls., Niagara sand 1,130-64 feet.

Kansas Fields

(Continued from Page 245)

C S half section 36-30-35w, Grant County, was bottomed at 2,742 feet and produced 5,000,000 feet of gas after acidizing.

United Production Co. No. 1 Pinney, C SW section 27-30-36w, produced 4,500,000 feet of gas and was completed at 2,673 feet, total depth.

Stevens County

Kuhn Brothers No. 1 Curtis, C NE section 25-31-39w, Hugoton field, Stevens County, produced 6,884,000 feet of gas at 2,620 feet, total depth, completed.

Pioneer Petroleum Co. No. 1 Williams, C section 12-35-38w, set 10-inch casing at 651 feet.

Additional New Work

Barbara Oil Co. No. 2 Holmes, C NE NE section 28-33-13w, Barber County, had dug cellar and pits. Pryor & Lockhart No. 1 Pickens, CWL E half SW section 34-30-14w, was a rig.

In Cowley County, Murta & Wilson No. 1 Stuber, SE NE NE section 27-30-5e, was a cellar.

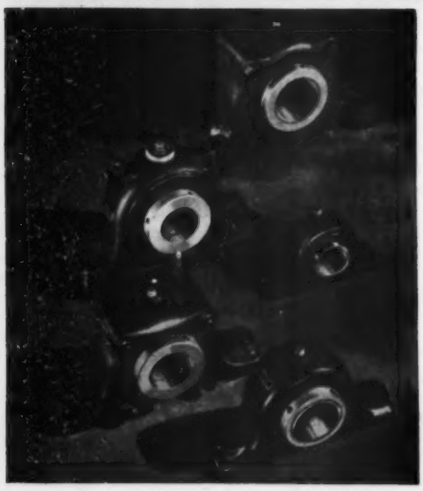
In Pawnee County, Phillips Petroleum Co. No. 1 Johnson, C NE SW section 8-20-19w, was moving in material. Mid-Continent Petroleum Corp. No. 1 Bixby, NW cor. section 24-20-16w, was a cellar.

In Rooks County, Texa Trading Co. No. 1 Probst, SW SW NE section 18-6s-9w, wildcat, was a rig. In Sedgwick County, Steinbuchel No. 1 McAdams, SW SW NE section 28-29-1e, had spudded and shut down.

Czechoslovakian Output

Crude oil production in Czechoslovakia during August amounted to about 10,353 bbls., a decline of more than 12 per cent compared with 11,788 bbls. in July and 6.7 per cent below August, 1936.

LINK-BELT *Anti-friction* BEARINGS



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Texas and Louisiana Gulf

By F. L. SINGLETON

NEW POOLS IN TWO PARISHES IN LOUISIANA COASTAL AREA

HOUSTON, Tex., Oct. 8.—Two new oil fields were added to the Louisiana sector of the Gulf Coast district the past week, while along the Texas side prolific production was indicated for the southwest flank of the old Orange field in Orange County.

The Abbeville field, Vermilion Parish, which was proven for distillate production in March of this year, was converted into an oil field by the completion of Continental Oil Co. No. 1 Brookshire which flowed 360 bbls. of 41.5 gravity oil per day through a 3/16-inch choke, with tubing pressure 1,800 pounds and casing pressure 2,500 pounds. Production was obtained by perforating the casing with 18 holes in the Miocene section at 7,884-90 feet. This test was scheduled to be drilled to a depth below 12,000 feet and reached a depth of 11,909 feet were mechanical trouble developed. Following two drill stem tests at 11,940-45 feet and at 10,935-43 feet which showed salt water, the hole was plugged back and completed at its present depth.

The well is located a quarter of a mile east of the discovery well that was completed for a distillate producer through perforations at 7,666-75 feet. The discovery well has the distinction of being the deepest well drilled in the world, having reached a depth of 12,216 feet where high gas pressures resulted in mechanical trouble, causing the well to be plugged back and completed in the shallow sand. Abbeville is one of several distillate fields which have been brought in as wet gassers and later converted into prolific oil fields by additional development. The field is held jointly by Continental Oil Co. and Gulf Oil Corp. with the majority of their holdings centering around section 26-12s-3e, just southwest of the town of Abbeville.

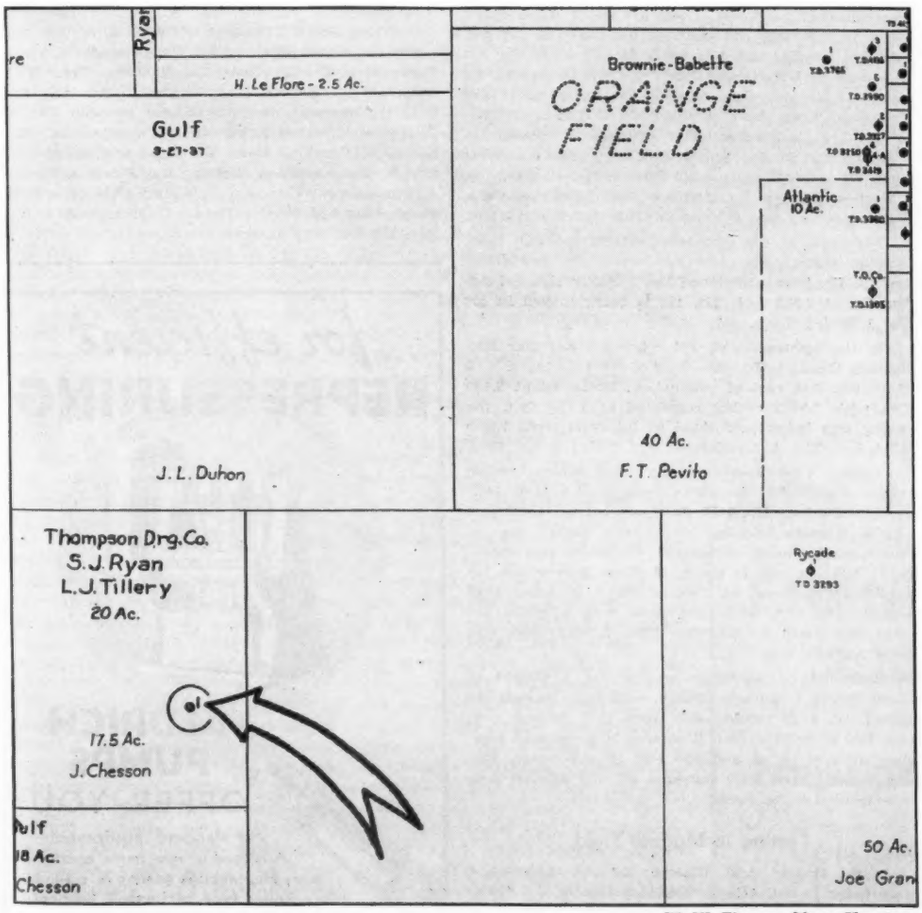
The Quarantine Bay Prospect, Plaquemines Parish, although not listed on the producing list was assured of commercial production by the showing of Gulf Oil Corp. No. 3 State. On a 12 minute drill stem at 8,127-8,144 feet, the total depth it showed 1,500 feet of pipe line oil with no salt water and 100 pounds of pressure. A Schlumberger survey showed the sand section at 8,123-31 feet which recorded 10 ohms resistivity. Casing will probably be cemented for a production test. This is the second sand to be encountered as a previous core at 6,464-72 feet carried good odors of oil and gas. Location is in section 17-19s-17e.

Prospects in New Fields

Three fields opened in the district this year had prospects for additional producers. At South Jennings, Acadia Parish, Loffland Brothers No. 1 Isaac Fontenot, section 16-10s-3w is bottomed at 8,751 feet and is waiting on orders after running a Shlumberger survey. Sand with an oil odor was cored at 8,667-71 feet, sand showing oil at 8,671-85 feet and from 8,685-8,738 feet. The well is about 75 feet lower than the discovery well which was completed as a distillate producer. It is possible that the well is low enough on structure to produce oil. At the Venice Dome Plaquemines Parish, Tide Water Associated Oil Co. was running a Schlumberger survey at No 4 Manhattan Fruit Co. before running casing for a production test. Sand showing oil was cored at intervals from 7,120 to 7,263 feet, total depth. Additional sands above this section were encountered at 5,900, 6,400 and 6,900 feet. The sand section is reported to have been encountered about 70 feet higher than the discovery well.

At Bayou Des Allemands, St. Charles Parish, Amerada Petroleum Corp. No. 1 St. Charles Land Co., 945 feet due west of the discovery well, section 38-15s-20e cored shale and sand showing oil at 6,294-29 feet and from 6,929-34 feet, 1 foot of oil sand was recovered. It is coring below 7,100 feet.

An additional producer for the Big Lake field, Cameron Parish was indicated by the showing of Union Sulphur Co. No. 2 J. O. Hebert. Gas sand was cored at 8,385-47 feet and oil sand from 8,447-63 feet. It is coring in sand below 8,500 feet. Same company's No. 1 P. D. Hebert was sidetracked at 8,443 feet and is drilling below 8,471 feet. Both wells are located in section 18.



W. W. Zingery, Maps, Houston

A portion of the Orange field, Orange County, showing location of Tillery and Ryan No. 1 Chesson on the southwest flank which is being tested at 5,946 feet where it showed for a large producer on a drill stem test

Pipe Line Outlet

Production at North Crowley, Acadia Parish which has been shut in due to the lack of an outlet will be moved from the field by a three-mile 4-inch pipe line which is being constructed to Standard Oil Co. of Louisiana's new 150-mile pipe line which is scheduled to be in operation the first of the week. The feeder line will tie into the 8-inch line at Crowley where the company has one of its pump stations. Humble Oil and Refining Co. has completed two large producers in the field, and has two wells drilling, while a third location was announced, No. 1 H. J. Habetz in section 45-8s-1e.

Considerable attention was centered on the Wax Lake Prospect in St. Mary Parish, where Texas Co. is plugging back its No. 1 State Bateman Lake preparatory to testing. The hole was carried to a depth of 11,808 feet and has been plugged back to 11,100 feet. A short string of 5-inch casing is to be cemented on bottom. A previous string of 7⅝-inch casing was cemented at 10,515 feet. Schlumberger surveys are reported to have shown favorable results at 9,600 and 9,900 foot levels. Location is is section 21-16s-12e.

Drilling has started on Humble Oil and Refining Co.'s second test at the Lirette field in Terrebone Parish. It is No. 1 Frank Wurzlow, about a half mile northwest of the discovery well in section 6-19s-19e. The discovery well, No. 1 Ellender produced pipe line oil below 11,000 feet, but was recently plugged back and completed for a distillate well at 10,520-24 feet after it began to show large quantities of salt water.

Texas Gulf Coast

Along the Texas Coast interest was centered on the outcome of a production test scheduled to be made at Tillery and Ryan No. 1 J. Chesson that has prospects of opening a flank drilling campaign for the south flank of the old Orange field in Orange County. Located about a half mile from the nearest production in the William Dyson Survey an 8 minute drill stem test at 5,940-46 feet, the total depth, showed 1,350 feet of 29 gravity oil. Seven-inch casing has been

cemented at 5,930 feet. Sand showing oil, considered to be the Frio, was cored at 5,878-79 feet and at 5,938-43 feet, a 5-foot core of soft sand showing oil was recovered. This is one of the oldest fields in the district having been opened in 1913. It is considered a deep seated salt dome and all production has been developed from lenticular sands consisting of the Pliocene, Miocene and Oligocene (Marginulina) at various intervals from 2,400 to 5,600 feet. Protection in the area is held by Shell Petroleum Corp., Gulf Oil Corp., Sun Oil Co., Stanolind Oil and Gas Co. and several independents.

First attempts to open production from a deeper sand about a mile south of the Segno field proved disappointing. Gulf Oil Corp. No. 8 Wing bottomed at a corrected depth of 6,755 feet was plugged back to 6,662 feet, and on a 12-hour test through perforations at 6,261-64 feet, it flowed 531 bbls. of fluid, 50 per cent salt water and the balance oil. The perforations have been cemented off and another test is to be made, probably at a high level. Since the well topped the Cook Mountain at 6,518 feet, the sands below that depth were apparently not favorable enough to warrant a test.

Production tests were being made on two wells in the Sandy Point field, Brazoria County, and another had cemented casing after coring the sand. H. J. DeArman No. 1 Edmundson, 6,000 feet west of production was perforated at 6,520-30 feet and is shutdown after it flowed salt water. It will probably be plugged back and retested. The same operators No. 3 Fite, perforated casing at 6,483-96 feet and is flowing into the pits, but no gauge had been taken. Stanolind Oil and Gas Co. No. 2 Fite, cored gas sand 6,455-66 feet, oil sand at 6,487-94 feet, and sandy shale showing oil at 6,494-96 feet. The hole is bottomed at 6,498 feet and 5¾-inch casing was cemented at 6,492 feet. The Discorbis was topped at 5,692, Heterostegina at 6,015 feet and the Marginula at 6,107 feet.

Watch Heyser Outpost

Operators in the Heyser field, Calhoun and Victoria Counties, were watching the progress of Magnolia Petroleum Co. No. 4 Lander, a half mile east of production, which has prospects of opening a deeper sand. The well is coring ahead after a drill stem test at 5,917-26 feet showed 60 feet of gas-cut mud with a salty taste. Four additional producers were completed. They were George Echols No. 1 W. H. Bennett, Humble Oil and Refining Co. No. 17-B P. H. Welder, Portilla Drilling Co. No. 10-C P. H. Welder and Sun Oil Co. No. 3 Coffey.

In the Fairbanks field, Harris County, Amerada Petroleum Corp. and Stanolind Oil and Gas Co. No. 3 Carpenter, F. Fry Survey, perforated casing at 6,813-20 feet and on a 10-hour test flowed 254 bbls. of fluid of which 6 per cent was salt water. Tubing pressure was 1,500 pounds and casing pressure 1,600 pounds. It is shut down awaiting orders.

Dry Hole in Hardin

In the northern part of the Hardin field, Liberty County, J. W. Fraser No. 1-B Lynott, J. Robeson Survey, cored salt water sand at 7,666-67 feet and was abandoned at 7,696 feet. There are seven active operations in the field and contract has been let for two additional wells. Jack Frazier is digging cellar for No 2 Lynott and Buffman; Gulf Oil Corp. is rigging up for No. 1 Hinson, while Jameson and Byron and Strake Petroleum Corp. have spudded No. 1 Hinson and No. 2 and 3 Finley respectively. Woodley Petroleum Co. was moving in for No. 4 McMurtry, and contracts were let for drilling Humble Oil and Refining Co. No. 1 Partlow and No. 1 Chambers. Shell Petroleum Corp. No. 1 Hanchey was drilling in shale below 6,716 feet.

Northeast of the discovery well of the Call field, Newton County, Republic Production Co. and Houston Oil Co. have abandoned No. 2 Peavy Moore Lumber Co. at 7,372 feet. The rig is being moved in for No. 2 Sabine Tram.

In the Spruger field, Tyler County, Republic Production Co. and Houston Oil Co. were testing No. 5 Hurd 933 feet east of production. Bottomed at 8,180 feet with 7-inch casing cemented at 7,759 feet, the casing was being perforated at intervals from 7,690-7,711 feet. This is the deepest test drilled in the field.

Jackson County received its third wildcat within recent weeks with the announcement of Sam G. Harrison and others No. 1 H. A. Myers located southwest of the Mauritz field in the O. York Survey No. 12. North of the town of Laward, Cockburn and others No. 1 Mike Strauss in the A. M. Clare Survey was being closely watched as it cored ahead in water sand below 5,424 feet. Sand and shale with a slight gas odor was cored at intervals from 5,257-70 feet and from 5,274-78 feet.

Merit Oil Co. continues testing No. 1 Wright at Cedar Bayou, Chambers County, with little success obtained. On a 15 minute drill stem test through perforations at 6,434-39 feet, it showed 30 pounds of pressure, 25 feet of oil and 800 feet of salt water. The perforations have been squeezed off and another test is scheduled to be made.

Testing in Magnet Field

In the Magnet field, Wharton County, three wells were being tested. Atlantic Refining Co. No. 6-B Cockburn is bottomed at 5,540 feet with 7-inch casing cemented at 5,537 feet. Humble Oil and Refining Co. No. 3 Cockburn is bottomed at 5,540 feet with 5½-inch casing cemented at 5,535 feet and a squeeze job is being made at 5,525-30 feet before testing. Texas Crusader No. 3 Cockburn is pulling screen and liner after it failed to flow from a total depth of 5,540 feet.

Locations for three wildcats were made in Galveston, Hardin and Colorado Counties. In the A. Dickinson Survey, Galveston County, Sun Oil Co. No. 1 Cade is located 466 feet from the north and east lines of the survey. In Hardin County John Mayo is moving in for No. 1 Hayden while in Colorado County, O. C. Garvey has derrick up for No. 1 Buback-Ernest in the M. Lapham Survey, approximately 7½ miles north of Eagle Lake.

New Officers of Petroleum Section National Safety Council

The new officers of the Petroleum Section of the National Safety Council chosen at the National Safety Congress in Kansas City, Mo., follow:

Executive committee — General chairman, H. W. Boggess, Sinclair Prairie Oil & Gas Co., Tulsa; vice chairman, J. H. Brown, Tide Water Oil Co., New York; news letter editor, F. R. McLean, Socony-Vacuum Oil Co., Inc., White Star Division, Detroit; secretary, H. N. Blakeslee, American Petroleum Institute.

Engineering committee chairman—E. D. Murphy, Mid-Continent Petroleum Corp., Tulsa; Health committee chairman—P. E. Keegan, Shell Oil Corp., Houston, Tex.; Program committee chairman—A. W. Breeland, Lone Star Gas Co., Dallas, Tex.; Publicity committee chairman—J. L. Risinger, Magnolia Petroleum Co., Dallas, Tex.; Statistics committee chairman—J. W. Meyers, Standard Oil Co. (New Jersey), New York; Visual education committee chairman—C. A. Miller, Texas Co., Houston, Tex.; Atlantic division chairman—L. C. Woodbridge, Socony-Vacuum Oil Co., New York; Great Lakes division chairman—R. T. Henderson, Standard Oil Co. of Ohio, Cleveland; Gulf division chairman—William Grant, Jr., refining department, Humble Oil & Refining Co., Baytown, Tex.; Mid-Continent division chairman—J. D. McCamey, Carter Oil Co., Tulsa; Pacific division chairman—C. J. Nobmann, Shell Oil Co., San Francisco; Rocky Mountain division chairman—R. O. Traylor, Standard Oil Co. (Indiana), Casper, Wyo.

Past general chairmen—R. W. Black, Standard Oil Co. of New Jersey, Elizabeth, N. J.; R. S. Bonsib, chief safety inspector, Standard Oil Co. (New Jersey), New York; V. R. Currie, Texas Co., Houston, Tex.; R. E. Donovan, Standard Oil Co. of California, San Francisco; C. L. Hightower, United Gas System, Houston, Tex.; G. O. Lockwood, Cities Service Oil Co., Bartlesville, Okla.; George F. Prussing, Union Oil Co., Los Angeles; R. B. Roaper, Humble Oil & Refining Co., Houston, Tex.; E. J. Senne, Socony-Vacuum Oil Co., Inc., New York; C. W. Smith, Standard Oil Co. (Indiana), Chicago; D. J. Wallace, Sinclair Oil Co., Tulsa.

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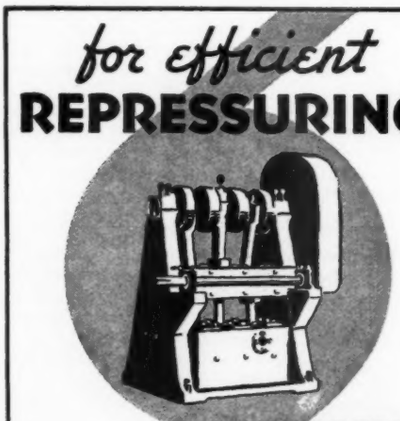

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Canadian Fields

Completions and Operations in Northwest and in Ontario

By VICTOR LAURISTON

CHATHAM, Ontario, Nov. 6.—Crude and naphtha production from all Alberta fields in September totaled 281,154 bbls., a daily average of 9,372 bbls. compared with 271,898 bbls. in August, a daily average of 8,771 bbls.

In spite of proration, October figures will probably exceed those for September. With a succession of new completions in late October and early November, some of them quite large wells, the Turner Valley potential production is now estimated around 20,000 bbls. a day, more than double the actual production in August and September.

New Proration Rate Established

As a result of the rapidly increasing production, Royalite Oil Co. announced proration at the rate of 45 per cent of potential to be effective at 8 a.m. on November 1. A similar step was taken by British American Oil Co. In connection with the new measure of proration, J. H. McLeod, president and production manager of Imperial Oil, Ltd., issued the following statement:

"Since it first became necessary to prorate production from crude wells in the Turner Valley field, the Royalite Oil Co.'s pipe lines to Calgary have handled an average of 8,541 bbls. per day. At that time, the combined resources of Imperial Oil, Ltd., and of those companies whose purchases Royalite facilities were handling, was 7,500 bbls. a day.

"On October 28, the known potential of crude oil production of wells in Turner Valley was approximately 15,700 bbls., with two wells—Royal Crest and Commoil No. 1—to be added to this figure when their potential can be determined. For purposes of calculation, it is estimated that the potential of these two wells is 2,300 bbls. per day, making a total of 18,000 bbls. per day available at the present time.

"Imperial Oil, Ltd., has agreed to take the entire output of the Royalite Oil Co.'s trunk line for an indefinite period, and at the present time Royalite is undertaking the looping of one of its 4-inch lines with 12 miles of 6-inch line. The capacity of the present system is slightly in excess of 10,000 bbls. per day; with the completion of the present addition it is hoped by January 1, 1938, that the Royalite Oil Co. will be in a position to handle 13,000 bbls. per day from the field to Imperial Oil, Ltd.'s Calgary refinery.

"At the present time deliveries being accepted by Royalite Oil Co. are far in excess of pipe line capacity and it has become necessary to reduce the prorated allowance of crude wells to 45 per cent of their potential. The duration of this rate will naturally depend on the potential of further completions established.

"Proration at the rate of 45 per cent of potential will be put into effect at all wells whose production is handled by Royalite Oil Co.'s pipe lines at 8 a.m. November 1, 1937."

In accordance with previous arrangements, potential production of wells will be determined by systematic official tests conducted by the petroleum and natural gas division of the Alberta lands and mines department.

Turner Valley Producers

In the September Turner Valley production, the Royalite-Sterling Pacific wells led with 75,121 bbls. for the month. Other Royalite wells produced 38,316 bbls. The largest individual producer, Davies-Royalite No. 2, ranked third with 37,829 bbls. and Turner Valley Royalties No. 1 was fourth with 21,486 bbls. B. & B. Oil Co. No. 1 came fifth with 17,444 bbls. Among the newer completions, Brown Oil Corp. Nos. 1 and 2, in production part of September, yielded 4,855 bbls.; Monarch Royalties No. 1 gave 15,062 bbls. and Richland Royalties No. 2 yielded 7,388 bbls.

West Side Completions

Among the new completions, Commoil No. 1, LSD 15, section 29-18-2w5, appears to be the largest. It finished at 7,475 feet, more than 475 feet in the Madison limestone and blew itself in under its own pressure after bailing about 2,000 feet of rotary fluid. Flush production started at a rate exceeding 3,000 bbls. a day, but the first official test showed 1,600 bbls. in 23 hours, coming through 6-inch casing; with gas flow estimated at 1,400,000 feet a day. The flow was limited by the capacity of the separator, lime pump and tankage, and officials estimated the normal flow better than 2,000 bbls. a day. It was temporarily prorated on the basis of 1,300 bbls. potential, pending installation of additional equipment and a second test to determine the true potential.

The well was drilled by Commoil, Ltd., a subsidiary of Commonwealth Petroleums, Ltd. of Calgary. It proves the field a half mile west of Turner Valley Royalties No. 1 discovery well and opens a considerable area west of the crude oil line for new drilling. Commoil No. 2 will likely be drilled on the same 80-acre lease, due south of No. 1, and the company may also participate in the completion of adjoining tests.

Farther north on the west flank, Royal Crest Petroleums No. 1, drilled by the R. A. Brown group, in LSD 9, section 32-18-2w5, finished at 7,114 feet, about 458 feet in the Madison. The well, a northwesterly offset to No. 5 Sterling Pacific, was swabbed for some days and then acidized before coming into production. It started flowing by heads and was put on the separator, flush production running around 2,880 bbls. a day. This later settled to about 526 bbls.

Among the newer wells, Model-Spooner-Reward No. 1, LSD 4, section 28-18-2w5, is rated with potential of 1,200 bbls. Share Royalties No. 1, N half LSD 8, section 29-18-2w5, made about 480 bbls. Granville Oils No. 1, LSD 16, same section, averaged 225 bbls. Four Star Petroleum No. 1, LSD 13, section 28-18-2w5, finished in the lime at 7,104 feet, was acidized, increasing production from around 400 to 680.4 bbls.

In the southwest extension of the field, Prairie Royalties No. 1, LSD 16, section 17-18-2w5, finished at 7,315 feet, some 485 feet in the Madison, settled to around 650 bbls. a day. It was acidized, resulting in a flush production of 2,876 bbls. on a 24-hour test. Settled production will be considerably smaller.

The largest well in the field is still Davies-Royalite No. 2, LSD 13, section 21-18-2w5, with a potential around 3,000 bbls. after acidizing.

Tests in the Limestone

In section 28-18-2w5, Three Point Petroleums, LSD 12, got the Madison limestone at 6,562 feet and finished below 6,969 feet. It is swabbing and testing production with early indications of a good crude producer.

In section 33-18-2w5, Royalite Oil Co. No. 6 Sterling Pacific, LSD 5, is below 6,776 feet after getting the limestone at 6,683 feet.

In section 32-18-2w5, West Flank Oil Co. No. 1, LSD 1, got the lime around 6,700 feet and has cemented casing.

In section 29-18-2w5, National Petroleum Corp. No. 1, S half, LSD 8, which got the lime at 6,786 feet, is drilling with cable tools below 6,900 feet with considerable crude in the hole.

In the southwest extension, Firestone Petroleums No. 1, LSD 13, section 16-18-2w5, offsetting Prairie Royalties No. 1 producer to the east, is below 6,713 feet, after getting the Madison at 6,345 feet.

West Side Drilling

In West Central Turner Valley, Brown Oil Corp. No. 3, LSD 15, section 19-19-2w5, is in the Lower Benton formation below 5,576 feet.

In section 5-19-2w5, Vulcan Brown Petroleums No. 1, LSD 10, is deepening below 1,631 feet after plugging back.

In section 32-18-2w5, Royalite Oil Co. No. 28, LSD 16, is below 1,912 feet. National Petroleum Corp. No. 3, LSD 15, is preparing to start drilling. West Turner Petroleums has a location for No. 2 in LSD 7, same section. West Flank Oil Co. No. 4, LSD 1; West Flank No. 5, on the line between LSDs 1 and 8, and West Flank No. 6, LSD 8, are digging cellars.

In the same section, Shamrock Petroleums, Ltd., is arranging for a test on acreage in LSDs 13 and 14, about a quarter mile west of National Petroleum Corp. No. 3 location.

In section 28-18-2w5, Richland Royalties No. 1, LSD 12, is in the upper Benton formation below 3,210 feet. Richland No. 2, LSD 5, is in the upper Blairmore below 5,765 feet.

In section 29-18-2w5, Command Oils No. 1, LSD 14, offsetting Commoil No. 1 producer to the west, is preparing to resume from 810 feet. Davies Petroleum No. 1, LSD 2, is installing rotary equipment to resume from 3,508 feet. Sunburst Oils No. 1, LSD 1, is reaming out to run larger casing to bottom at 2,610 feet.

In section 21-18-2w5, Barsac Royalties No. 1, LSD 12, is below 190 feet. Brown Oil Corp. No. 4, LSD 4, is below 840 feet.

In section 20-18-2w5, Spy Hill Royalties No. 1, LSD 16, is rigging rotary to resume from 4,020 feet. Royal Canadian Oils No. 1, LSD 15, is below 6,507 feet. Sunset Oils No. 1, LSD 10, is below 6,535 feet after getting the Home sand at 6,515 feet.

In section 19-18-2w5, Scottish Petroleums No. 1, LSD 16, is below 195 feet.

In section 17-18-2w5, Sundance Royalties No. 1, LSD 9, is working on derrick.

Far South Tests

In the south end of Turner Valley, National Petroleum Corp. No. 2, LSD 14, section 9-18-2w5, is preparing to resume with rotary from 3,005 feet where 10¾-inch casing was cemented. Rotary tools from National No. 1 will be used. Mid-Royal Oils No. 2, LSD 3, same section, is rigging.

In section 33-17-2w5, Davies Petroleums No. 3, LSD 7, is moving cable tools from Davies No. 1, and will spud this month.

Okalta Structure

On the Okalta field, west of the main Turner Valley structure, Okalta Oil Co. No. 6, LSD 3, section 30-18-2w5, is below 2,307 feet, and logging high in comparison with Turner Valley tests.

Far West Well Abandoned

Two miles west of the Turner Valley crude area, South End Petroleums No. 1, LSD 6, section 36-18-3w5, has been abandoned as dry at 5,285 feet.

Border Fields

In the Taber field, southern Alberta, Plains Petroleum Corp. No. 2, LSD 11, section 25-9-17w4, finished at 3,222 feet, is adjusting production equipment. Tubing with sand packer with one-quarter inch bottom choke is being used and oil will be flowed to a 500-bbl. tank heated by the Dutch oven method before running to storage tanks. Early tests indicated potential production around 250 bbls. a day. Plains No. 3, section 26-9-17w4, is deepening after running casing to 2,740 feet; and is expected to get the sand around 3,215 feet. The company is planning to start two additional wells east of No. 2. Amerada Oils No. 1, LSD 13, section 19-9-16w4, has derrick up

(Continued on Page 273)

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Michigan Field Report

By
O. C. PRESSPRICH

PROMISING GLADWIN TESTS; GOOD WELLS IN SALEM FIELD

SAGINAW, Mich., Nov. 8.—Extensions of existing oil fields joined with tests in prospective new fields to give interest to an otherwise uneventful week in Michigan's petroleum industry. Attention again turned away from the Buckeye field where five completions and a possible nonproducer failed to attract attention in competition with wildcats prospecting in several untested areas of Gladwin County.

Continuing as a "hot" section was Secord Township, where Whitehill, Clovis & Drury's No. 1 Bosley, NE SE SE of section 11, met a temporary setback, but still loomed as a commercial producer, indicating a possible new Gladwin County field. After cave-ins had been cleared from the hole, drilling proceeded, only to run into big water. Operations had previously been shut down with more than 1,500 feet of oil in the hole. The well will now be plugged back to the point where promising indications began to show, and will be acid treated. It was estimated on the basis of the previous show that the well probably would make 50 to 70 bbls. after acid—a favorable enough indication to warrant further exploration in Secord.

Coupled with the prospect of another field in Gladwin County, was application for a permit to drill made by Peter Bolger for his No. 1 Oscar Seitz, NW NW NE, section 23, Secord Township. The location is one mile west and one-quarter mile south of the Clovis & Drury well. A flurry of exploration is anticipated in the area, judging from the way lease and royalty men went into action when indications were favorable for a new pool.

Two other wildcats in Gladwin County, one of which represents an extension of the south Buckeye pool, were active from the standpoint of interest this week. In Billings Township McClanahan Oil Co. No. 1 Havens, SE NE NE section 9, bottomed at 3,512 feet with a hole full of oil giving indications of a commercial producer, and the first major extension of the south Buckeye pool. The well will be acidized this week. Billings Township lies to the southeast of the south Buckeye pool.

Sherman Township, Gladwin County, is being closely watched for results of the wildcat test of Dapar Oil Co & Charles E. Weller No. 1 Villenueve in the SW SW SE of section 11, located 10 miles north of Gladwin and nine miles west of the Secord Township wildcat. The Sherman township test was to probe the Dundee this week.

Interest in Nottawa Township's wildcat of the Boston Oil & Gas Co. in Isabella County faded this week after several weeks speculation, when the well was announced at about 40 bbls. daily after acid. The well was acidized last week, and was placed on the pump this week.

In Emerson Township of Gratiot County Redman Oil Co. No. 1 Creaser, in the NE SW SE of section 18, which attracted attention last week as indicative of a possible oil strike in Gratiot County after years of prospecting, was drilling in the Dundee this week. Its chief interest lies in its nearness to a wildcat test in section 17 which logged several shows a year ago before drilling into water. While the Creaser well held the hopes of Gratiot County of striking a producing well, Samuel Seigel No. 1 Kerr in the N half NW NE of section 36, Hamilton Township, Gratiot County, was plugged back and abandoned this week.

Buckeye Township

Doldrums hit the north and south Buckeye pools the past week, with three completions reported in the north pool, two in the south pool. Developments of significance were few, being headed by Sun Oil Co. No. 2-A Strohkirch, in the SE NE NW of section 10, which came in with an estimated 800 bbls. daily. Oil was reported flowing through the tubing as well as through the casing. While this test was successful as a western addition to the north pool, the same company's No. 6 Strohkirch, in the NW NW NW of section 10, refused to flow following acid, and is to be treated again. Beaver Trust No. 1-B Thompson, in the NW SW NW of section 13, is scheduled for treatment this week after a potential natural output of 400 bbls. Smith Petroleum Co. No. 3 Brenner, in the SE SE NW of section 14, is to be treated with acid after showing a 100-bbl. natural flow.

Two completions were reported in the south Buckeye pool. In section 24, where Jacob Beck's No. 1 Buehler wildcat, in the SW SW SW, hit the pay for a favorable northeast extension of the south pool, and a far-eastern outpost of the so-called midway pool. Indications were favorable for further exploration in the area. The well was reported to have flowed 150 bbls. naturally. An eastern offset of the Beck-Buehler well was brought into natural production when Pence & King's No. 1 Stahl, in the SW SE SW of section 24, developed 50 bbls. daily.

Isabella County—Sherman Township

Pure Oil Co. No. 5-B McClintoc, in the NE SE SE of section 33, picked up commercial production of 500 bbls. daily after it bottomed at 3,629 feet. The No. 7-B McClintoc, in the SW NW SW of section 33, was drilling ahead of 2,100 feet, and McClanahan Oil Co. No. 1 Terry, in the NW SE SW of section 32, was ahead of 1,800 feet.

Isabella-Broomfield

Pure Oil Co. No. 8 Willey, in the NW NW SE of section 4, was acidized last week and responded with approximately 275 bbls. daily. The east offset, the No. 9 Willey, was acidized, and developed 325 bbls. daily. The same company's No. 2 Skarritt, in the NE NE NE of section 5, was on top of the Monroe, and was to drill in this week.

Saginaw County

Bond Oil Development Co. No. 1 Schoonmaker, in the SE NE NE of section 1, Lakefield Township, was running 5-inch casing below 3,200 feet, with indications favorable.

Tuscola County

Brehm & Jaenicke Oil Co. No. 1 Boyce, in the SE NW SW of section 24, Wisner Township, was cased with 5-inch this past week, and topped the Dundee at 2,029 feet. It was expected to drill in this week. Approximately 220 feet of Dundee is found in the area, with the well running 16 feet higher on reported structure to the west.

Allegan County

Continued favorable production in the Salem Township pool of Allegan again focused attention on Michigan's new pool, with four producers added within the week. Another test in Trowbridge Township, slated for abandonment after failure in the Traverse, was drilled five feet deeper and now is rated as a commercial producer. The Trowbridge test was Louis Rose No. 1 Bartholoman, NW NW NW section 28. The well was reported to be making about 25 bbls. an hour, natural flow, after deepening five feet from 1,339 feet. Originally slated for abandonment, the well opens territory nearly 20 miles to the south of the Salem Township pocket. Other tests which added to the production of Salem this week include Muskegon Oil Co. No. 1 Seabright, NE SE NE section 21, estimated at about 900 bbls. daily, after acid. Lack of storage has prevented an accurate gauge. Allegan Crude Oil Co. No. 4 Heasley, in the NW NE NE section 21, is rated 750 bbls. daily after acid, and Michigan Devonian Petroleum Co. No. 3 Brower, in the NW SW NE of section 17, was given 2,000 gallons of acid and produced 500 bbls. of oil in 24 hours. It produced 100 bbls. naturally. Allegan City itself may lay claim to a commercial well if the Chadbourn Estate No. 1 in Allegan Township reacts according to hopes. A show of oil in the Traverse has raised hopes of a sufficient indication to warrant acidizing. Several other tests throughout Allegan County are scheduled to hit the pay streak soon.

Montcalm County

Another failure for Montcalm County was recorded the past week in C. H. Segar No. 1, B. F. Switzer, in section 10, Ferris Township, where the drill tapped brine at a depth of 3,396 feet.

Wildcatting Ventures Few

Fewer than the usual number of wildcat ventures were licensed in the past week's list of drilling permits issued by the state conservation department. In fact, only two of the 17 locations for which permits were issued could be classified as strictly wildcat.

One of these is H. C. Nelson No. 1 Walt Morris, SW SW NW of section 31, Churchill Township, Ogemaw County, and the other is Hogan, Inc., No. 1 Lyle Price, SW NW NW section 2, Lakefield Township, Saginaw County.

Gladwin, Allegan and Ogemaw counties shared equally in the week's permit list, with four each. Arenac County took two of the permits and Isabella, Montcalm and Saginaw one each.

Southwest Texas Fields

(Continued from Page 237)

the showings in Southern Minerals Corp. No. 2 King. Located in Block 6 of the King Farm Lots northwest of Agua Dulce which several weeks ago cored a sand testing oil and salt water at 4,020-33 feet. Bottomed at 6,219 feet it has been plugged back to the 4,000-foot sand in an attempt to complete.

Several Good Wells

Field activity in San Patricio and Aransas counties resulted in several good producers. In the McCampbell field of the latter county, the newly opened 7,200-foot sand showed one of the best producers in the field. The discovery well, Atlantic Refining Co. No. 1-D Porterfield made an initial production of 379.14 bbls. per day on a 3/16-inch choke.

In the same field, the Atlantic No. 1-C Porterfield, deepest test in the area, threatened to blow out at 8,880 feet. Operators plan to set protective casing when drill pipe, now stuck in the hole, is recovered.

San Patricio field operations center in the Plymouth and Midway fields. In the former field, three new producers were completed, and Midway gained one, completed on the west edge of production.

The latest Fault Line field to be brought in has been named the Nash Creek field. The discovery well, Carver & Ellison's No. 1 Rumpf, located 2½ miles southeast of the Darst Creek field, came in making 22 bbls. per hour from a crevice in the Raylor at 2,585 feet. A second test for the new field has been staked by F. M. Gallagher on the Howell tract in the Darst Survey, Guadalupe County.

A wildcat located 1¾ miles southwest of Falls City in Karnes County shows indications of possible production. The test, Ivan Howard's No. 1 Moczygemba, has sand showing oil at 2,174-78 feet, and is setting casing to make a test.

Travis County, another non-productive area has indications of oil in the wildcat, LaShelle and others No. 1 Giles, which has a show of oil in chalk at 650 feet and is coring ahead to test.

WILDCAT OPERATIONS

CALIFORNIA

IMPORTANT WELLS AND NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status
Hancock-Bush, No. 1-W Santa Maria, Santa Barbara	25-10-34	4,000	sd. sh. drlg.
Hancock-Bush, No. 2 C.L., Santa Maria, S. Barbara	30-10-33	2,975	sd. sh. dry.
Macrate, A. N., No. 2-R Santa Maria, Santa Barbara	23-10-34	1,791	sd. sh. drlg.
York Oil, No. 1 Doane, Santa Maria, Santa Barbara	27-10-34	2,571	sd. sh. drlg.
Pet. Prop., Inc., No. 1-R Santa Maria, Santa Barbara	19-10-33	2,286	dry; abd.
Sunshine Oil, No. 1-W Santa Maria, Santa Barbara	27-10-34	3,161	sd. sh. drlg.
Linnell Oil, No. 1 Santa Maria, Santa Barbara Co.	23-10-34	3,291	sd. sh. drlg.
Jones, Frank, No. 1 Santa Maria, Santa Barbara Co.	26-10-34	2,998	sd. sh. drlg.
Moore, E. H., No. 3 Sugar, Santa Maria, Santa Barbara	24-10-35	3,170	sd. sh. drlg.
Moore, E. H., No. 4 Sugar, Satna Maria, Santa Barbara	19-10-34	1,991	sd. sh. drlg.
Moore, E. H., No. 5 Sugar, Santa Maria, Santa Barbara	25-10-35	1,876	sd. sh. drlg.
Signal Oil, No. 1 Libeu, Santa Maria, Santa Barbara	26-10-34	2,281	sd. sh. drlg.
Union Oil, No. 2 Vincent, Santa Maria, Santa Barbara	30-10-33	4,064	pump. 80 b.d.
Union Oil, No. 3 Russell, Santa Maria, Santa Barbara	30-10-33	1,924	sd. sh. drlg.
Union Oil, No. 1 Vincent, Santa Maria, Santa Barbara	21-10-34	2,141	sd. sh. drlg.
Union Oil, No. 2 LeRoy, Santa Maria, Santa Barbara	24-10-35	5,230	pump. 125 b.d.
Union Oil, No. 17 Cal. Coast, Orcutt, Santa Barbara	27- 9-34	3,180	sd. sh. drlg.
O'Donnell, J. E., No. 1 Santa Maria, Santa Barbara	21-10-34	4,276	sd. sh. drlg.
Getty, George F., No. 1 Santa Maria, Santa Barbara	27-10-34	2,696	sd. sh. drlg.
Pac. West. Oil, No. 3-H Santa Maria, Santa Barbara	21-10-34	4,257	sd. sh. drlg.
Pac. West. Oil, No. 5-H Santa Maria, Santa Barbara	21-10-34	2,171	sd. sh. drlg.
Pac. West. Oil, No. 1-D.P., Santa Maria, Santa Barbara	27-10-34	4,422	pump. 770 b.d.
Rice Ranch Oil, No. 4 Orcutt, Santa Barbara Co.	23- 9-34	4,330	P.B. 3,732
Tide Water A. O., No. 1-L Santa Rita, Santa Barbara	3- 6-33	4,950	D.P. stuck
Field, O. C., No. 1-S.R., Lompoc, Santa Barbara Co.	11- 7-33	3,358	wet; idle
Pet. Securities, No. 6 Ranch, Shiells, Ventura Co.	3- 3-19	4,393	flow. 255 b.d.
Texas Co., No. 133 Shiells, Ventura Co.	4- 3-19	3,901	flow. 134 b.d.
Texas Co., No. 134 Shiells, Ventura Co.	4- 3-19	3,892	sd. sh. drlg.
Richfield Oil, No. 1 McFarland, Camarillo, Ventura	13- 2-21	4,665	basalt
Condor Oil, No. 1 Sespe, Ventura Co.	6- 4-19	2,193	cleaning out
Ivers, H. A., No. 14 Star, Sespe, Ventura Co.	1- 4-20	1,610	sd. sh. drlg.
Williamson Oil, No. 1 Sespe, Ventura Co.	1- 4-20	441	idle
Section 20 Oil, No. 1 Sespe, Ventura Co.	20- 5-19	531	hd. sh. drlg.
Speik Oil, No. 2 Sespe, Ventura Co.	33- 5-19	3,270	cleaning out
Colima Oil, No. 2 Sespe, Ventura Co.	25- 5-19	3,500	fishing
Topa Topa Oil, No. 3 Sespe, Ventura Co.	33- 5-19	4,410	sidetracking
Commander Oil, No. 7-F Piru, Ventura Co.	13- 4-19	286	idle
Skyline Oil, No. 1-H Hopper Canyon, Ventura Co.	13- 4-18	1,565	sd. sh. drlg.
Vai, Giovani, No. 1 Ojai, Ventura Co.	4- 4-21	1,889	idle
Continental Oil, No. 8 Grubb, San Miguelito, Ventura	30- 3-23	3,937	fish. D.P.
C. C. M. Oil, No. 2 Padre Canyon, Ventura Co.	23- 3-24	7,828	P.B. 6,625
Continental Oil, No. 4 Padre Canyon, Ventura Co.	15- 3-24	5,720	will redrl.
C. C. M. Oil, No. 11 Rincon, Ventura Co.	17- 3-24	3,208	will deepen
C. C. M. Oil, No. 17 Rincon, Ventura Co.	17- 3-24	4,245	flow. 450 b.d.
Oxnard Oil, No. 1 Oxnard, Ventura Co.	10- 1-22	6,302	P.B. 6,200
Tide Water A. O., No. 32 V.L.W., Ventura, Ventura	24- 3-23	4,630	sd. sh. drlg.
Tide Water A. O., No. 30 Lloyd, Ventura, Ventura	27- 3-23	6,640	sd. sh. drlg.
Tide Water A. O., No. 63 Lloyd, Ventura, Ventura	27- 3-23	4,810	cmtd. 4,635
Tide Water A. O., No. 69 Lloyd, Ventura, Ventura	27- 3-23	1,925	sd. sh. drlg.
Tide Water A. O., No. 135 Lloyd, Ventura, Ventura	27- 3-23	7,574	cleaning out
Tide Water A. O., No. 137 Lloyd, Ventura, Ventura	27- 3-23	10,060	flow. 251 b.d.
Tide Water A. O., No. 138 Lloyd, Ventura, Ventura	23- 3-23	3,897	sd. sh. drlg.
Tide Water A. O., No. 18 Hartman, Ventura, Ventura	22- 3-23	7,758	hd. sh. drlg.
Tide Water A. O., No. 27 Hartman, Ventura, Ventura	22- 3-23	6,404	sd. sh. drlg.
Shell Oil, No. 92 Taylor, Ventura Avenue, Ventura	20- 3-23	1,941	sd. sh. drlg.
General Pet., No. 13 Notten, Ventura, Ventura Co.	28- 3-23	8,410	O.S. drlg.
Tide Water A. O., No. 10-E-3 Lost Hills, Kern Co.	3-26-20	2,067	deepening
Texas Co., No. 2-27 Theta, Lost Hills, Kern Co.	2-26-20	1,134	rig to pump
Standard Oil, No. 6 United, Lost Hills, Kern Co.	2-26-20	1,592	cleaning out
Amerada Pet., No. 5 Beer, Devils Den, Kern Co.	22-26-19	3,015	sd. sh. drlg.
Goforth & Bradfield, No. 1 McKittrick, Kern Co.	18-30-22	793	pump. 25 b.d.
Franco-Western Oil, No. 14, McKittrick, Kern Co.	8-30-22	982	br. sh. drlg.
Par Mer Oil, No. 1 McKittrick, Kern Co.	6-31-22	1,191	br. sh. drlg.
Michels, George, No. 1 Ynez, Temblor, Kern Co.	36-29-20	1,610	P.B. 435
Standard Oil, No. 2 Randolph, Semi-Tropic, Kern Co.	14-27-23	6,250	sd. sh. drlg.
Continental Oil, No. 2 Wasco, Kern Co.	8-27-24	11,584	fish. D.P.
Seeco, No. 1 Armstrong, McFarland, Kern Co.	9-26-26	1,250	dry; abd.
Belridge Oil, No. 43-26 North Belridge, Kern Co.	26-27-20	8,100	br. sh. drlg.
Belridge Oil, No. 53-26 North Belridge, Kern Co.	26-27-20	8,410	flow. 3,820 b.d.
Belridge Oil, No. 27-8 North Belridge, Kern Co.	27-27-20	3,731	cleaning out
Belridge Oil, No. 61-27 North Belridge, Kern Co.	27-27-20	3,681	sd. sh. drlg.
Tide Water A. O., No. 7 North Belridge, Kern Co.	34-27-20	4,561	sd. sh. drlg.
Tide Water A. O., No. 1-21 North Belridge, Kern Co.	21-27-20	3,160	sd. sh. drlg.
Texas Co., No. 2 Martin, North Belridge, Kern Co.	22-27-20	2,483	sd. sh. drlg.
General Pet., No. 1 St. Helens, Belridge, Kern Co.	12-28-20	2,541	sd. sh. drlg.
Tampico Pet., No. 4 Round Mountain, Kern Co.	17-28-29	1,866	pump. 436 b.d.
Link Trucking, No. 1 Round Mountain, Kern Co.	30-28-29	1,695	run casing
Cal-Western Oil, No. 7 C.C., Round Mountain, Kern	12-28-28	1,397	sd. sh. drlg.
Vedder, D. G., No. 1 Bell, Round Mountain, Kern Co.	12-28-28	172	sd. sh. drlg.
Malone, F. H., No. 3 Mabry, Kern Front, Kern Co.	4-28-27	2,726	sd. sh. drlg.
California Star Oil, No. 3-80 Kern Front, Kern Co.	22-28-27	2,755	fish. liner
Texas Co., No. 11 Lehman, Kern Front, Kern Co.	23-28-27	2,057	scrape walls
Union Oil, No. 8 Del Rey, Kern Front, Kern Co.	11-28-27	1,900	bailing
Republic Pet., No. 14-S, Kern Front, Kern Co.	24-28-27	1,986	pump. 286 b.d.
Fuhrman, A., No. 12 Kern River, Kern Co.	28-28-28	620	dry; abd.
Morrison, C. S., No. 14-H, Kern River, Kern Co.	2-29-28	140	sd. sh. drlg.
Vedder, D. G., No. 3 B.N.B., Mount Poso, Kern Co.	32-26-28	1,752	pump. 220 b.d.
Ring Oil, No. 2 Bohen, Mount Poso, Kern Co.	32-26-28	1,690	pump. 245 b.d.
Ring Oil, No. 3 Bohen, Mount Poso, Kern Co.	32-26-28	1,670	O.S. drlg.
Ring Oil, No. 2 Louden, Mount Poso, Kern Co.	32-26-28	135	sd. sh. drlg.
Sunset Oil, No. 5 Vedder, Mount Poso, Kern Co.	28-26-28	1,604	pump. 60 b.d.
Texas Co., No. 12 Vedder, Mount Poso, Kern Co.	4-27-28	1,365	sd. sh. drlg.
Vedder Pet., No. 29-2 Lambert, Mount Poso, Kern Co.	29-26-28	1,807	P.B. 1,778
Vedder Pet., No. 25-1 Lambert, Mount Poso, Kern Co.	25-26-27	2,386	dry; abd.
Bargol Oil, No. 3 Newhope, Mount Poso, Kern Co.	11-27-27	1,235	C.P. 1,194
Framac Oil, No. 1 Brown, Mount Poso, Kern Co.	22-27-27	1,351	fish. D.P.
Baker, H. W., No. 2 Mount Poso, Kern Co.	28-27-27	2,012	idle
Hobbee Oil, No. 3 McVan, Mount Poso, Kern Co.	14-27-27	1,185	O.S. drlg.
Vanguard Oil, No. 8 Baker, Mount Poso, Kern Co.	33-27-28	1,719	pump. 481 b.d.
Vanguard Oil, No. 15 Baker, Mount Poso, Kern Co.	33-27-28	1,758	sd. sh. drlg.
Meridian Oil, No. 7 Turner, Fruitvale, Kern Co.	23-29-27	2,597	sd. sh. drlg.
Simmel, L. C., No. 2 Fruitvale, Kern Co.	23-29-27	3,772	O.S. drlg.
Western Gulf Oil, No. 10 Red Ribbon, Fruitvale, Kern	27-29-27	3,520	sd. sh. drlg.
Sandy Oil, No. 2 Fruitvale, Kern Co.	26-29-27	3,590	P.B. 3,317
Section Six Oil, No. 1 Mountain View, Kern Co.	6-31-29	6,020	cleaning out
American Expl., No. 1-G Mountain View, Kern Co.	18-30-29	4,792	redrlg. 4,550
Ohio Oil, No. 6 Derby, Mountain View, Kern Co.	33-30-29	5,292	cleaning out
Vesta Oil, No. 12 Mountain View, Kern Co.	19-30-29	4,290	sd. sh. drlg.
Hogan Pet., No. 5 Symons, Mountain View, Kern Co.	4-31-29	5,381	sd. sh. drlg.
Hogan Pet., No. 4 Bankline, Mountain View, Kern Co.	4-31-29	5,515	flow. 1,200 b.d
North American Consd., No. 2-7 Mountain View, Kern	9-31-29	4,784	sd. sh. drlg
Petrol. Prod., No. 1 Fruit, Mountain View, Kern Co.	4-31-29	5,815	rig to pump
Westbrook Oil, No. 1 Edison, Kern Co.	4-30-29	2,140	P.B. 1,988
Wood-Callahan Oil, No. 1 Harvey, Edison, Kern Co.	21-30-29	4,450	redrlg. 3,591
General Pet., No. 1 Houchin, Arvin, Kern Co.	27-31-29	7,501	sd. sh. drlg.
Arkelo Oil, No. 1 Lerdo, Kern Co.	23-28-26	10,050	idle
Union Oil, No. 1-34 Rio Bravo, Kern Co.	34-28-25	11,302	prod. test
Continental Oil, No. 1 Rosedale, Kern Co.	12-29-26	10,210	redrgl. 7,651
Superior Oil, No. 1 Krause, Greeley, Kern Co.	21-29-26	147	sd. sh. drlg.
Superior Oil, No. 9 KCL, Kreeley, Kern Co.	3-30-26	7,870	idle
Superior Oil, No. 10 KCL, Greeley, Kern Co.	3-30-26	2,261	sd. sh. drlg.
Standard Oil, No. 11-8 KCL, Greeley, Kern Co.	18-29-26	7,426	fish. D.P.
Standard Oil, No. 11-9 KCL, Greeley, Kern Co.	20-29-26	7,691	sd. sh. drlg.
Standard Oil, No. 11-10 KCL, Greeley, Kern Co.	17-29-26	7,730	sd. sh. drlg.
Standard Oil, No. 1-F Greeley, Kern Co.	20-29-26	7,716	sd. sh. drlg.
Standard Oil, No. 15-1 KCL, Ten Section, Kern Co.	27-30-26	5,360	sd. sh. drlg.
Standard Oil, No. 17-1 KCL, Ten Section, Kern Co.	9-29-26	2,995	sd. sh. drlg.
Shell Oil, No. 8-28-A KCL, Ten Section, Kern Co.	28-30-26	8,179	br. sh. drlg.
Shell Oil, No. 36-30-A KCL, Ten Section, Kern Co.	30-30-26	5,987	sd. sh. drlg.
Ohio Oil, No. 3-E, KCL, Ten Section, Kern Co.	14-30-25	8,129	O.S. drlg.
Standard Oil, No. 1 Magunden, Kern Co.	2-30-28	4,184	sd. sh. drlg.
Monticello Oil, No. 4 Midway-Sunset, Kern Co.	27-31-22	1,582	br. sh. drlg.
C. C. M. Oil, No. 44-21 Midway-Sunset, Kern Co.	21-32-23	2,305	pump. 128 b.d.
C. C. M. Oil, No. 1-U.S., Midway-Sunset, Kern Co.	30-32-24	2,985	dry; abd.
Hallmark Oil, No. 8 Midway-Sunset, Kern Co.	25-12-24	2,800	pump. 75 b.d.
Hallmark Oil, No. 9 Midway-Sunset, Kern Co.	25-12-24	971	sd. sh. drlg.
Brookshire Oil, No. 3 Midway-Sunset, Kern Co.	24-31-22	2,524	sd. sh. drlg.

KEY TO ABBREVIATIONS USED IN DRILLING REPORTS

Abd., abandoned.
Bldg., building.
B.D., barrels daily.
B.P., back pressure.
B.R., building rig.
Br. sh., brown shale.
B.S., basic sediment.
C.P., casing pressure.
Cd. or Crd., cored.
C.D., corrected depth.
Cg., coring.
C.L., center line.
Cmtd., cemented.
C.O., cleaning out.
Comp., completed.
Compr., compressor.
C.P., casing pressure, also cement through perforations.
Csg., casing.
D.D., drilling (or drilled) deeper.
Drlg. or Drg., drilling.
Drk. or Dk., derrick.
D.S., drill stem.
D.&A., dry and abandoned.
Fsg., fishing.
Gbo., gumbo.
G.I., gas injection.
Gr., gravity.
Gr. sd., gray sand.
Grn. sh., green shale.
Hd. sd., hard sand.
H.F.W., hole full of water.
I.P., initial production.
L., lime.
L.D.D., later drilled deeper.
Lnr., liner.
Loc., location.
M.I.M., moving in material.
M.I.R., moving in rig.
M.I.R.T., moving in rotary tools.
M.O.T., milling on tools.
O.I.H., oil in hole.
O.S., oil sand.
O.T.D., old total depth.
O.W.D.D., old well drilling deeper.
O.W.P.B., old well plugging back.
P.B., plugging or plugged back.
P.B.P., plugging big pipe.
P.L., pipe line.
P.L.O., pipe line oil.
Pmpg., pumping.
P.O.P., putting on pump.
P.P., pulled pipe.
Rd. sd., red sand.
Rd. sh., red shale.
Recmt., recemented.
Rmg., reaming.
Redrlg., redrilling.
Rng., running.
R.O.G., rig on ground.
R.P., rock pressure.
R.U., rigging up.
R.U.R., rigging up rotary.
R.U.R.T., rigging up rotary tools.
R.U.S.T., rigging up standard tools.
R.&T., rods and tubing.
S. or Sd., sand.
S.D., shut down.
Sdy. sh., sandy shale.
Sdtr., or St., sidetracking.
S.D.P.L., shut down for pipe line.
S.D.W.O., shut down awaiting orders.
S.G., show gas.
Sh.&L., shale and lime.
S.I., shut in.
S.I.P., shut in, prorated.
S.L.M., steel line measurement.
S.O., show oil.
S.O.G.&W., show of oil, gas and water.
Spdg. or Spd., spudding.
S.R., straightreaming.
Stdg., standardizing (also standing).
S.W., salt water.
Swbg., swabbing.
T.A., temporarily abandoned.
Tbg., tubing.
T.D., total depth.
T.P., tubing pressure.
Tr., tract.
U.R., underreaming.
W.I.H., water in hole.
W.O., workover.
W.O.C. or W.O.C.S., waiting on cement to set.
W.P., working pressure.
W.S.O., water shutoff.
W.S.S.O.K., water shutoff O.K.
W.S.O.N.G., water shut off no good.
W.S.R. or W.O.S.R., wait on standard rig.
Wtr., water.

Hoyt, Otis, No. 7 Midway-Sunset, Kern Co.	7-11-23	1,844	sd. sh. drig.
Richfield Oil, No. 14 Fellows, Midway-Sunset, Kern	6-32-23	1,128	O.S. drig.
Standard Oil, No. 19 Monarch, Midway-Sunset, Kern	26-12-24	2,589	sd. sh. drig.
Standard Oil, No. 2-25-L Midway-Sunset, Kern Co.	25-12-24	3,012	sd. sh. drig.
Honolulu Oil Corp., No. 26-A Midway-Sunset, Kern	14-32-24	3,220	sd. sh. drig.
National Oil, No. 30 Midway-Sunset, Kern Co.	35-32-23	1,775	O.S. drig.
Gibson Oil, No. 5 O'Brien, Midway-Sunset, Kern Co.	6-11-23	2,821	O.S. drig.
Texas Co., No. 1 Pioneer, Midway-Sunset, Kern Co.	33-11-23	4,396	hd. sh. drig.
Texas Co., No. 25 Midway-Sunset, Kern Co.	32-32-24	3,170	tested wet
Texas Co., No. 26 Midway-Sunset, Kern Co.	32-32-24	3,249	cleaning out
Texas Co., No. 27 Midway-Sunset, Kern Co.	32-32-24	2,917	sd. sh. drig.
Texas Co., No. 28 Midway-Sunset, Kern Co.	32-32-24	169	sd. sh. drig.
Richfield Oil, No. 1-H-A Elk Hills, Kern Co.	1-31-24	2,987	sd. sh. drig.
Central Valley Oil, No. 1 Fresno, Fresno Co.	1-12-20	132	hd. sd. drig.
Bergman, Harry, No. 1 Dos Palos, Fresno Co.	12-12-11	6,138	will deepen
Pure Oil, No. 1 Cantua, Fresno Co.	31-18-17	7,550	sd. sh. drig.
Dauphin Dev., No. 1 Alcade, Fresno Co.	30-21-14	1,091	sd. sh. drig.
Jacalitos Oil, No. 1 Jacalitos, Fresno Co.	14-21-15	1,869	sd. sh. drig.
K. N. D. A., No. 4-18-J Kettleman North, Fresno Co.	18-21-17	11,681	gr. sd. drig.
K. N. D. A., No. 43-34-J Kettleman North, Fresno Co.	34-21-17	7,017	sd. sh. drig.
K. N. D. A., No. 41-4-P Kettleman North, Fresno Co.	4-22-17	8,065	completing
K. N. D. A., No. 83-4-P Kettleman North, Fresno Co.	4-22-17	6,685	cleaning out
K. N. D. A., No. 27-12-P Kettleman North, Kings Co.	12-22-17	6,831	br. sh. drig.
K. N. D. A., No. 38-12-P Kettleman North, Kings Co.	12-22-17	5,814	br. sh. drig.
G. N. D. A., No. 6-6-Q Kettleman North, Kings Co.	6-22-18	8,034	gr. sd. drig.
K. N. D. A., No. 27-6-Q Kettleman North, Kings Co.	6-22-18	7,620	br. sh. drig.
Standard Oil, No. 27-21-J Kettleman North, Fresno	21-21-17	6,970	br. sh. drig.
Standard Oil, No. 27-33-J Kettleman North, Fresno	33-21-17	8,160	sd. sh. drig.
Standard Oil, No. 2-11-P Kettleman North, Kings Co.	11-22-17	6,971	br. sh. drig.
Standard Oil, No. 76-1-P Kettleman North, Kings Co.	1-22-17	6,000	sd. sh. drig.
Standard Oil, No. 21-13-P Kettleman North, Kings Co.	13-22-17	3,290	sd. sh. drig.
Superior Oil, No. 1 Huffman, Kettleman No., Fresno	29-21-17	10,050	coring
Temblor Oil, No. 1-B Kettleman Middle, Kings Co.	25-23-18	8,515	show. gas
Pyramid Prod., No. 1 Pyramid Hills, Kings Co.	27-24-18	514	sd. sh. drig.
Amerada Pet., No. 1 Carano, Los Banos, Merced Co.	19-10-11	3,967	br. sh. drig.
Little Cuyama Oil, No. 1 Adelaida, San Luis Obispo	3-10-26	1,571	sd. sh. drig.
Elba Oil, No. 1 Pajaro, Monterey Co.	6-13-2	3,970	recmtd. 3,871
Amerada Pet., No. 1 Deterding, Rio Vista, Solano Co.	36- 4-2	4,377	cmtd. 4,270
Standard Oil, No. 2 Weyl, McDonald Is., San Joaquin	25- 2-4	5,298	sd. sh. drig.
Standard Oil Co., No. 1 Morris, Delano, Tulare Co.	36-24-23	9,755	hd. sh. drig.
Magnet O. & G., No. 1 Delano, Tulare Co.	29-24-24	7,555	idle
Trico O. & G., No. 1 Tulare Lake, Tulare Co.	28-24-23	2,657	sd. sh. drig.
Standard Oil, No. 1 Hooper, Woodland, Yolo Co.	32- 9-1	5,181	redrig. 3,670
Standard Oil, No. 1 Cook, Dunnigan, Yolo Co.	32-12-1	5,000	gr. sd. drig.
Empire O. & G., No. 1 Woodland, Yolo Co.	S- 9-3	231	sd. sh. drig.
Wilshire Oil, No. 1 Half Moon Bay, San Mateo Co.	20- 6-5	2,487	sd. sh. drig.
Texas Co., No. 1 Crows Landing, Stanislaus Co.	30- 6-8	1,495	sd. sh. drig.

IMPORTANT WELLS AND SOUTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status
Richfield Oil, No. 1-H El Segundo, Los Angeles Co.	7- 3-14	7,494	rig to pump
Richfield Oil, No. 2-SF El Segundo, Los Angeles Co.	7- 3-14	5,830	sd. sh. drig.
Richfield Oil, No. 1 McCray, El Segundo, Los Angeles	12- 3-15	6,142	sd. sh. drig.
Sunshine Oil, No. 1 G.W. El Segundo, Los Angeles	12- 3-15	1,459	sd. sh. drig.
Sunshine Oil, No. 1 C.W. El Segundo, Los Angeles	12- 3-15	5,167	sd. sh. drig.
Sunshine Oil, No. 2 C.W. El Segundo, Los Angeles	12- 3-15	1,783	sd. sh. drig.
Sunshine Oil, No. 1-W El Segundo, Los Angeles Co.	12- 3-15	4,971	sd. sh. drig.
Apex Pet., No. 1 Elsie, El Segundo, Los Angeles Co.	12- 3-15	6,530	sd. sh. drig.
Tide Water A. O., No. 1 El Segundo, Los Angeles Co.	8- 3-14	7,518	sd. sh. drig.
Ohio Oil, No. 8 Gough, El Segundo, Los Angeles Co.	7- 3-14	7,516	sd. sh. drig.
Ohio Oil, No. 9 Gough, El Segundo, Los Angeles Co.	7- 3-14	5,791	sd. sh. drig.
Texas Co., No. 5 Security, El Segundo, Los Angeles	18- 3-14	7,292	sd. sh. drig.
Ruchti Pet., No. 1 El Segundo, Los Angeles Co.	12- 3-15	6,840	sd. sh. drig.
Standard Oil, No. 4 Ref., El Segundo, Los Angeles	13- 3-15	7,246	sd. sh. drig.
Standard Oil, No. 5 Ref., El Segundo, Los Angeles	13- 3-15	5,791	sd. sh. drig.
Standard Oil, No. 6 Ref., El Segundo, Los Angeles	13- 3-15	3,182	sd. sh. drig.
Pac. Western Oil, No. 1 El Segundo, Los Angeles Co.	7- 3-14	7,450	flow. 1,120 b.d.
Getty Oil, No. 1-A El Segundo, Los Angeles Co.	7- 3-14	7,198	sd. sh. drig.
Lakeside Oil, No. 10-1 Elsie, El Segundo, Los Angeles	18- 3-14	2,568	sd. sh. drig.
Wilshire Oil, No. 9-1 Elsie, El Segundo, Los Angeles	12- 3-15	5,660	sd. sh. drig.
Wilshire Oil, No. 9-2 Elsie, El Segundo, Los Angeles	12- 3-15	4,974	sd. sh. drig.
Standard Oil, No. 84 L.A.I., Inglewood, Los Angeles	17- 2-14	1,455	cmtd. 1,455
C. C. M. Oil, No. 33-T Torrance, Los Angeles Co.	16- 4-14	3,710	will deepen
Keystone Oil, No. 2 Torrance, Los Angeles Co.	16- 4-14	3,423	pump. test
Kavanaugh, E. C., No. 1 Palos Verdes, Los Angeles	17- 4-14	5,526	P.B. 5,340
Tide Water A. O., No. 4 Cypress, Potrero, Los Angeles	34- 2-14	4,673	O.S. drig.
Shell Oil, No. 92 Reyes, Dominguez, Los Angeles Co.	33- 3-13	7,860	O.S. drig.
Union Oil, No. 51 Callender, Dominguez, Los Angeles	33- 3-13	3,491	sd. sh. drig.
Union Oil, No. 56 Callender, Dominguez, Los Angeles	33- 3-13	8,790	sd. sh. drig.
Union Oil, No. 57 Callender, Dominguez, Los Angeles	33- 3-13	6,251	sd. sh. drig.
Union Oil, No. 10 Carson, Dominguez, Los Angeles	33- 3-13	5,773	sd. sh. drig.
Barnsdall Oil, No. 18 O'Dea, Rosecrans, Los Angeles	18- 3-13	6,200	sd. sh. drig.
Union Oil, No. 35 H.P., Rosecrans, Los Angeles Co.	18- 3-13	7,197	sd. sh. drig.
Union Oil, No. 17 Rosecrans, Los Angeles Co.	18- 3-13	7,390	sd. sh. drig.
Macrate, A. N., No. 2 Rosecrans, Los Angeles Co.	17- 3-13	8,403	P.B. 8,345
Barnsdall Oil, No. 2-S.F., Newhall, Los Angeles Co.	26- 4-17	5,084	redrig. 3,420
Holbrook Pet., No. 1 Newhall, Los Angeles Co.	28- 4-16	6,250	dry; abd.
Royal Lands, No. 1 Ramona, Castaic, Los Angeles	8- 4-17	821	hd. sd. drig.
General Pet., No. 23 Ford, Wilmington, Los Angeles	4- 5-13	2,950	milling
General Pet., No. 5 Isco, Wilmington, Los Angeles	4- 5-13	4,171	sd. sh. drig.
General Pet., No. 1-P, Wilmington, Los Angeles Co.	33- 4-13	3,600	redrig. 3,140
General Pet., No. 7-T Wilmington, Los Angeles Co.	4- 5-13	2,162	sd. sh. drig.
Allied Pet., No. 25, Wilmington, Los Angeles Co.	32- 4-13	3,176	sd. sh. drig.
Bankline Oil, No. 8-D.H., Wilmington, Los Angeles	34- 4-13	2,981	sd. sh. drig.
Bankline Oil, No. 23-D.H., Wilmington, Los Angeles	34- 4-13	3,230	sd. sh. drig.
Bankline Oil, No. 8-P.T., Wilmington, Los Angeles	34- 4-13	2,630	sd. sh. drig.
Baker Oil, No. 1 Wilmington, Los Angeles Co.	35- 4-13	3,502	sd. sh. drig.
Buckeye Union Oil, No. 1 Bill, Wilmington, L. Angeles	32- 4-13	3,600	flow. 501 b.d.
Caminol Oil, No. 1-P Wilmington, Los Angeles Co.	33- 4-13	3,600	pump. 112 b.d.
Colter & McAdoo, No. 1 Wilmington, Los Angeles	32- 4-13	3,450	sd. sh. drig.
Exeter Oil, No. 2 Banning, Wilmington, Los Angeles	32- 4-13	3,050	sd. sh. drig.
Macson Oil, No. 55-C, Wilmington, Los Angeles Co.	32- 4-13	3,145	sd. sh. drig.
McDonald & Burns, No. 2-B Wilmington, Los Angeles	32- 4-13	3,625	flow. 275 b.d.
Mid-Cal. Oil, No. 6-B.G., Wilmington, Los Angeles	33- 4-13	160	sd. sh. drig.
Neilson et al, No. 1 Wilmington, Los Angeles Co.	33- 4-13	3,600	flow. 290 b.d.
Pac. Western Oil, No. 1-R Wilmington, Los Angeles	33- 4-13	5,197	sd. sh. drig.
Pongratz, Gus, No. 1 Nix, Wilmington, Los Angeles	33- 4-13	3,605	sd. sh. drig.
Royalty Serv., No. 2-P Wilmington, Los Angeles Co.	32- 4-13	3,590	sd. sh. drig.
Royalty Serv., No. 22-7 Wilmington, Los Angeles Co.	33- 4-13	2,960	sd. sh. drig.
Selegna Drig., No. 10 Wilmington, Los Angeles Co.	33- 4-13	3,094	sd. sh. drig.
Union Pacific, No. 44 Wilmington, Los Angeles Co.	34- 4-13	3,348	flow. 710 b.d.
Union Pacific, No. 47 Wilmington, Los Angeles Co.	3- 5-13	2,953	sd. sh. drig.
Union Pacific, No. 54 Wilmington, Los Angeles Co.	4- 5-13	2,600	sd. sh. drig.
Union Pacific, No. 56 Wilmington, Los Angeles Co.	4- 5-13	2,525	sd. sh. drig.
Union Pacific, No. 60 Wilmington, Los Angeles Co.	4- 5-13	3,479	sd. sh. drig.
Union Pacific, No. 63 Wilmington, Los Angeles Co.	34- 4-13	3,099	sd. sh. drig.
Union Pacific, No. 64 Wilmington, Los Angeles Co.	34- 4-13	2,891	sd. sh. drig.
Union Pacific, No. 65 Wilmington, Los Angeles Co.	34- 4-13	1,983	sd. sh. drig.
Union Pacific, No. 5-C Wilmington, Los Angeles Co.	33- 4-13	3,318	sd. sh. drig.
Wilton Oil, No. 2 Wilmington, Los Angeles Co.	32- 4-13	2,879	sd. sh. drig.
Alford Oil, No. 1 C.Y., Wilmington, Los Angeles Co.	22- 4-13	1,652	sd. sh. drig.
Julian, C. A., No. 1 Koch, Walnut, Los Angeles Co.	5- 2-9	3,000	fish. D.P.
British American Oil, No. 1 Pico, Los Angeles Co.	12- 2-12	3,140	sd. sh. drig.
Davis, No. 1 Garvey Ranch, Montebello, Los Angeles	22- 2-11	536	sd. sh. drig.
Texas Co., No. 18 Baldwin, Montebello, Los Angeles	5- 2-11	3,282	sd. sh. drig.
St. Helens Pet., No. 20-M, Montebello, Los Angeles	6- 2-11	4,873	hd. sd. drig.
Texas Co., No. 4 Bauman, Long Beach, Los Angeles	19- 4-12	4,742	sd. sh. drig.
Texas Co., No. 14 Harlow, Long Beach, Los Angeles	19- 4-12	4,502	sd. sh. drig.
Rico Pet., Inc., No. 1 Long Beach, Los Angeles Co.	30- 4-12	4,080	sd. sh. drig.
Richfield Oil, No 5 Davis, Long Beach, Los Angeles	19- 4-12	2,709	sd. sh. drig.
Richfield Oil, No. 4 Keon, Long Beach, Los Angeles	29- 4-12	3,762	sd. sh. drig.
Union Oil, No. 100 Santa Fe Springs, Los Angeles Co.	6- 3-11	10,804	sd. sh. drig.
General Pet., No. 37-A Snta Fe Springs, Los Angeles	6- 3-11	3,900	redrig. 1,851
Texas Co., No. 7-W Santa Fe Springs, Los Angeles Co.	6- 3-11	6,530	whipstocking
Continental Oil, No. 40 Bixby, Seal Beach, Orange Co.	2- 5-12	7,501	O.S. drig.
Shell Oil, No. 4-1 Columbia, Olinda, Orange Co.	9- 3-9	6,997	hd. sd. drig.
Brea Canyon Oil, No. 36 Brea Canyon, Orange Co.	2- 3-10	4,552	fish. D.P.
Standard Oil, No. 127 Murphy, West Coyote, Orange	18- 3-10	3,240	cmtd. 3,224
Standard Oil, No. 11 Coyote, East Coyote, Orange Co.	22- 3-10	4,125	cleaning out
Arrowhead Oil, No. 2 Bradford, Richfield, Orange	32- 3-9	4,632	P.B. 4,555
Texas Co., No. 2 Isaacs, Richfield, Orange Co.	32- 3-9	3,715	P.B. 3,460
Union Oil, No. 46 Chapman, Richfield, Orange Co.	29- 3-9	3,390	O.S. drig.
Oil Income, No. 1 Anderson, Yorba, Orange Co.	22- 3-9	1,030	hd. sd. drig.
Hjorth & Mohr, No. 1 Yorba, Orange Co.	22- 3-9	1,403	P.B. 1,345
Berco Oil, No. 1 Milhous, Yorba, Orange Co.	22- 3-9	386	sd. sh. drig.
Beverly Hills Pet., No. 1 Fricke, Yorba, Orange Co.	21- 3-9	1,914	rig to pump
Mid-State Pet., No. 1 Oliver, Yorba, Orange Co.	22- 3-9	1,600	rig to pump
Bachmann Pet., No. 1 Page, Yorba, Orange Co.	22- 3-9	1,591	O.S. drig.
Shell Oil, No. 1-H Anaheim, Orange Co.	9- 4-10	7,276	sd. sh. drig.

KANSAS

Week Ending November 6 (Descriptions are East unless marked otherwise)

Barber County

Kansas Oil Corp. No. 1 Mease, NE SE SE sec. 27-30-11w. Set 12½-in. csg. 196 ft.

Olson Oil Co. and Skelly Oil Co. No. 1 Elsea, SW SE NW sec. 27-32-14w. T.D. 5,174 ft.. C.O.

Palmer Oil Corp. et al No. 1 Warwick, C NW sec. 29-31-10w. Rig.

Barton County

Brouk and National Ref. Co. No. 1 Gory, NW SW sec. 10-17-13w. T.D. 3,352 ft.; pot. 255 B.O.; completed.

Martin & Foraker et al No. 1 Dick Est., NE SW SW sec. 31-19-11w. Rig.

Arch Merriam et al No. 1 Norris, NE NE NW sec. 33-17-11w. Drlg. 1,945 ft.

Tom Palmer et al No. 1 Polzin, NW SE sec. 4-16-12w. T.D. 3,326 ft.; 2,500 ft. O.I.H.

C. L. Price No. 1 Hammeke, NE NE SW sec. 12-18-12w. Sil. 3,415-27 ft.; 1,800 ft. O.I.H.; bails 4 bbls. wtr. every other day.

Shell Pet. Corp. No. 1 Ehrlich, SW cor. sec. 1-16-14w. Drlg. 3,100 ft.

Shell Pet. Corp. No. 1 Peterman, SE NE SE sec. 13-16-14w. T.D. 3,366 ft.; acd.: pot. 1,654 B.O.; completed.

Stanolind O. & G. Co. No. 1 Hagen A, SE sec. 21-20-11w. Drlg. 3,045 ft.

Chase County

Cal.-Ill.-Kans. Oil Co. No. 1 Evans, SW NW sec. 11-22-9e. Drlg. 2,100 ft.

Chautauqua County

C. L. Brosius et al No. 1 Garrett, NW SW NW sec. 26-32-11. H.F.W. 2,076 ft., T.D.; P.B. 1,545 ft.; C.O.

W. G. Buffington No. 1 Fisher, CWL SW NW sec. 10-34-9e. S.D. 1,677 ft.

C. R. Craft No. 1 Lagree, SE NW NE sec. 8-32-12e. T.D. 2,080 ft.; P.B. 687 ft.

Harrison No. 1 Brown, NE SE NE sec. 19-34-10. S.D. 820 ft.

Ingot Oil Co. No. 1 McKee, SW NE SW sec. 21-32-12. T.D. 1,209 ft.; acd.

I. W. Siegel No. 1 Temple, SW cor. sec. 31-32-12. Rig.

Clark County

Olson Oil Co. et al No. 1 Watkins, SW NW sec. 23-32-21w. Drlg. 3,690 ft.

Cowley County

Arthur Brewer No. 1 Shepard, NE NE SE sec. 20-32-4e. Drlg. 1,600 ft.

Murta & Wilson et al No. 1 Stuber, SE NE NE sec. 27-30-5e. Drlg. 90 ft.

Pryor & Lockhart No. 1 Brown, NE SE SE sec. 34-33-2e. Sil. 3,853-64 ft., T.D.; P.B. 3,403 ft.; shot.

Smith & Price No. 1 Henderson, SW SW sec. 25-32-6. Drlg. 2,100 ft.

Ellis County

Aylward Prod. Co. et al No. 1 Berens, SE SE sec. 10-14-16w. H.F.W. 3,490-93 ft.; D.&A.

Brunson Drlg. Co. et al No. 1 Weisner, SE SW SE sec. 31-13-17w. T.D. 3,651 ft.; P.B. 3,624 ft.; pump. 12½ bbls. fluid in 7 hrs.,26% wtr.

Colonial Oil Co. and Bernheimer No. 1 Albert, SW SW NE sec. 31-12-18w. Set 8-in. csg. 2,730 ft.; drlg. 2,775 ft.

Lario O. & R. Co. No. 1 Bell, NW NW NE sec. 8-12-18w. Rng. csg. 3,765 ft.

P. G. Reynolds et al No. 1 Karlin, NW cor. sec. 13-12-18w. U.R. 8-in. csg. to 3,635 ft.

C. E. W. Skiles et al No. 1 Jensen, SW SE NE sec. 26-12-18w. S.D. 2,910 ft.

Ellsworth County

Hinkle et al No. 1 Alden, SE SE SW sec. 17-17-10w. T.D. 3,331 ft.. D.&A.

Ford County

Olson Oil Co. et al No. 1 Fowler, C SW sec. 26-27-22w. Coring 4,712 ft.

Grant County

R. K. Wilson No. 1-22 Helmly, C SE sec. 22-28-37w. Drlg. 2,412 ft.

Greenwood County

Eagle Oil Co. No. 1 Stine, NE NE SE sec. 13-28-10. U.R. 8-in. 730 ft.

Ward McGinnis et al No. 1 Henly Estate SW cor. sec. 25-25-9. T.D. 2,234 ft.; R. F.W.; P.B.; S.D.

John Nichols et al No. 1 Central Life, SE SW sec. 35-25-12. Spd. and S.D.

Whittaker & Johnson No. 1 Cannon, CEL SE NW sec. 8-26-13. Cmt. cave 950-1,000 ft.; drlg. cmt.

Harvey County

Allison et al No. 1 Hawks, SE SW NE sec. 16-24-1w. Drlg. 1,970 ft.

Jackson County

Lemmick Oil Co. No. 1 Marble Savings Bank, NE cor. sec. 26-9-14. Spd. and S.D.

Kingman County

Carter Oil Co. No. 1 Davis, C E½ NE NE sec. 24-28-8w. T.D. 4,571 ft.; D.&A.

Logan County

Morgan, Flynn, Cobb et al No. 1 McMillen, C NW sec. 9-13-37w. Base Sil. L. 5,430 ft.; Granite 5,450-65½ ft., T.D.; D.&A.

McPherson County

C. E. Ash Drlg. Co. No. 1 Broman, NE NE NW sec. 19-17-4w. U.R. 6-in. 3,408 ft.

Boyle & Grossman No. 1 Diener, SE SE NE sec. 35-19-1w. Fsg. 2,320 ft.

Fred C. Frank et al No. 1 Doles, SE NW NE sec. 12-19-1w. Set 8-in. 2,775 ft.; S.D.

Meade County

Pacific Mid-West Co. No. 1 Rexford, NE SE SW sec. 8-30-29w. Drlg. 900 ft.

Mitchell County

Geo. Siedhoff et al No. 1 Greiss, SW SW SE sec. 16-8-10w. S.D. 4,022 ft.

Ness County

Marshall Drlg. Co. et al No. 1 Anderson, SW NW sec. 23-16-24w. Surface hole.

Trojan O. & G. Co. No. 1 Moses, C SW NW sec. 10-18-25w. Fsg. 300 ft.

Trojan O. & G. Co. No. 1 Page Milling Co., SE SE NW sec. 36-18-26w. Fsg. 3,265 ft.

Osborne County

Fred C. Chaddox and Atlantic Ref. Co. No. 1 Slater, NE SW NE sec. 33-10-15w. Sil. L. 3,829 ft.; T.D. 3,835 ft.; H.F.W.; abd.

Pawnee County

Stanolind O. & G. Co. and Amerada Pet. Corp. No. 1 Jantz, SW cor. sec. 25-20-16w. Drlg. 3,191 ft.

Phillips County

C. W. Davidson et al No. 1 Elliff, SE NE NE sec. 35-5-18w. S.D. 350 ft.

Pratt County

Colonial Oil Co. et al No. 1 Hays, SE SW sec. 4-26-12w. Drlg. 3,840 ft.

Penn Drlg. Co. et al No. 1 Holland, SW NW SE sec. 6-26-12w. Drlg. 2,130 ft.

Skelly Oil Co. et al No. 1 Adams, SE NW NE sec. 2-28-11w. T.D. 4,300 ft.; fsg.

Reno County

Lib Phillips et al No. 1 McPheeters, NE NE NW sec. 22-26-8w. Spd. and S.D.

Sam Schneider et al No. 1 Kroecker, NE cor. sec. 12-22-5w. Drlg. 3,160 ft.

Westgate-Greenland et al No. 1 Popp, SW SW NE sec. 7-25-4w. Drlg. 3,013 ft.

Rice County

Bell O. & G. Co. et al No. 1 Timbers, NW NE sec. 8-21-8w. Sil. 3,503 ft.; T.D 3,522 ft.; D.&A.

Gerbrand-Pulse Oil & Drilling Co. No. 1 Wellman, SW cor. sec. 22-21-9w. T.D. 3,327 ft.; F. 22,481,000 ft. gas; comp.
Gillespie et al No. 1 Strong, NE NW sec. 9-18-8w. Spd. and S.D.
John Hanna et al No. 1 Marshall, NE NW NW sec. 30-18s-8w. S.D. 1,530 ft.
Skiles et al No. 1 Campbell, SE SE NE sec. 28-19-9w. T.D. 2,957 ft. (cor.); P. 10 B.O. and 60 B.W.; to deepen.
W. E. Witt et al No. 1 Fair, NW SE SE sec. 4-22-8w. T.D. 2,890 ft.; S.D. repairs.

Rooks County

C. R. Craft et al No. 1 Ziegler, NE SW sec. 8-10-16w. U.R. 6-in. csg. to 3,304 ft.
Graham et al No. 1 Fike, SW cor. sec. 9-9-17w. T.D. 3,326 ft.; pmpd. 50 B.O. and 35 B.W. in 8 hrs.; fsg.
Producers Oil Co. No. 1 Ham, SW SW NW sec. 25-7-19w. Spd. 60 ft.
Superior Oil Corp. et al No. 1 Casey, SE SE sec. 35-10-19w. Simpson at 3,648 ft.. cg. 3,652 ft.
Texas Co. No. 1 McCarroll, C W½ W½ NW sec. 29-10-17w. Drlg. 3,295 ft.
Texo Trading Co. No. 1 Probst, SW SW NE sec. 18-6-19w. Surface hole.

Rush County

Duwe & Brouk No. 1 Lebsack, SE SE NE sec. 13-16-16w. Sll. 3,492-95 ft.; 1,500 ft sulfur water in hole in 2½ hrs.; T.D 3,512 ft.; S.D.O.
Earl Wakefield et al No. 1 Zimmerman, SE SE SW sec. 7-16-18w. T.D. 3,644 ft.; D.&A.
Wakefield & Brouk No. 1 Kerbs, NW NW SE sec. 11-17-16w. Drlg. 900 ft.

Russell County

Cities Service Oil Co. et al No. 1 Eichman, SW SE sec. 12-15-14w. T.D. 3,213 ft.; pot. 866 B.O.; comp.
Emrichs et al No. 1 Anderson, NE SE SW sec. 33-15-11w. Spd. and S.D.
Murfin and Vernon O. & G. Co. No. 1 Pearson, NE cor. sec. 31-15-15w. Drlg. 845 ft.
Parks No. 1 Opdycks, SW cor. sec. 20-14-13w. Sll. L 3,170 ft.; T.D. 3,189 ft.; 2,700 ft. O.I.H.
Phil-Han Oil Co. No. 1 Deines, NE NE NW sec. 33-14-14w. Sll. L 3,183 ft.; T.D. 3,205 ft.; D.&A.
C. L. Price No. 1 Sebesta, NE NE sec. 36-15-11w. Set 7-in. 2,950 ft.
Winkler & Koch No. 1 Jones, SE SE NW sec. 22-14-13w. Sll. 3,180 ft.; S.D.O.

Sedgwick County

Continental O. Co. et al No. 1 Oehlert, NW SE sec. 7-27-4w. Drlg. 2,250 ft.
Frank Hudson et al No. 1 Fulton, NE SE sec. 35-28-1e. Fsg. 1,550 ft.
McKnab No. 1 Garrett, SE SW SW sec. 18-29-2e. S.D. 100 ft.
L. W. Murfin et al No. 1 Martin, SE NW sec. 32-28-1e. T.D. 3,491 ft.. P. 475 B. O. in 24 hrs.
National Ref. Co. No. 1 fee, SE NE SE sec. 26-27-2e. T.D. 2,875 ft.; run. 6-in.
M. Steinbuchel et al No. 1 Shaffer, SW SW NW sec. 18-25-1e. Drlg. 2,112 ft.
W. G. Talbott et al No. 1 Downs Est., SE SE NW sec. 32-28-2e. T.D. 2,232 ft.; 7,400,000 ft. gas; comp.
Union O. & R. Co. et al No. 1 Howell, SW cor. sec. 6-29-1e. Drlg. 2,100 ft.

Stafford County

W. P. Faulkner No. 1 Moses, NW SW sec. 9-22-13w. S.D. 2,170 ft.
Kessler O. & G. Co. et al No. 1 Pinkston, NE NW sec. 17-22-14w T.D. 3,939 ft.; sulfur wtr.; abd.
Fred Rust et al No. 1 Drach, NE SW sec. 12-22-13w. Sll. 3,693 ft.; T.D. 3,705 ft.; swb. 20 B.O. in 1 hr.; 3,100 ft. O.I.H.
Stanolind O. & G. Co. No. 1 Shank, SE cor. sec. 17-24-13w. T.D. 4,130 ft.. S.S.O.
Stanolind O. & G. Co. No. 1 Tiechman, SE cor. sec. 13-22-13w. Sll. 3,750 ft.; T.D. 3,756 ft.; S.O.
Torry & Feaster et al No. 1 McConaughay, NE SE NW sec. 8-24-13w. Drlg. 2,052 ft.

Stevens County

United Prod. Co. No. 1 Beardsley, C N½ sec. 12-31-35w. Set 7-in. 2,525 ft.; W. O.C.

Sumner County

Cities Service Oil Co. No. 1 McCoy, SE SW sec. 11-35-2e. Drlg. 3,026 ft.
W. M. McKnab No. 1 Blair, SW cor. sec 7-30-1e. T.D. 3,869 ft.; swbs. 75 to 100 B.O.P.D.
Magnolia Pet. Co. No. 1 Baird, SW SE SE sec. 2-30-4w. T.D. 4,401 ft.; pulling tubing, to drill out and test.
R. J. Wixson No. 1 Newton, SE SE sec. 21-30-2e. Drlg. 2,530 ft.

Trego County

Thurman Hill et al No. 1 Lawson, SW SW NW sec. 7-14-22w. Drlg. 2,640 ft.
R. E. McNeely et al No. 1 Hille, C SE NE sec. 22-15-24w. Coring 4,310 ft.
Phillips Pet. Co. No. 1 Trego, C SE SW sec. 14-12-23w. 6-in. csg. 4,070 ft.; T.D. 4,257 ft.; fsg.

Wallace County

Wilcox O. & G. Co. No. 1 Parker, SE SE NE sec. 9-11-40w. Drlg. 5,100 ft.

Woodson County

Chas. Reeser et al No. 1 Weide, NW SE sec. 18-25-14. Drlg. 750 ft.

Washita County

John Koberg No. 1 Harms, NW NW NE sec. 6-10-16w. T.D. 4,260 ft.; S.D.

SOUTHERN OKLAHOMA

Atoka County

C. M. Sheldon and Gardner Pet. Co. No. 1 Lee, NE NW SW sec. 2-4s-10e. T.D. 1,335 ft.; acd. in effort to loosen stuck tools; waiting.

Carter County

E. M. Boring No. 1 Sullivan, SE SE SW sec. 6-5s-1e. Drlg. 150 ft.

Coal County

Carter Oil Co. No. 1 Claytor, C W½ NE SW sec. 27-2n-9e. T.D. 6,342 ft.; Halliburton test.
Phillips Pet. Co. No. 1 Beck, SE SW SW sec. 6-1n-9e. Drlg. 4,852 ft.

Cotton County

J. W. Amyx No. 1 Ash, SE cor. sec. 7-4s-10w. Drlg. 740 ft.
Bowers & Wise No. 1 Pendergraft, NW SE SW sec. 4-4s-12w. Spd. 16 ft.; S.D.

Jefferson County

Massad & Swansberger No. 1 Barrett, NE SE SE sec. 14-6s-6w. T.D. 1,890 ft.; S.D.

Johnston County

Patton et al No. 1 McCrummins, C SW SW NE sec. 16-1s-6e. S.D. 1,380 ft.
W. T. Sheldon No. 1 Chapman, C NW NW sec. 26-4s-6e. T.D. 2,182 ft.; U.R. 6⅝-in. csg.

Marshall County

F. W. Merrick, Inc., No. 1 Robinson, NE cor. sec. 33-7s-4e. Drlg. 2,542 ft.
Paul Robb et al No. 1 Vittitoe, C NE SE sec. 11-5s-4e. O.W.D.D.; C.O. to 720 ft.; S.D.

Murray County

Meyer & Greenup No. 1 Arbuckle, NW NW NE sec. 18-2s-3e. Spd. and S.D.
O. O. Owens No. 1 Fryer, NE SE NE sec. 34-1s-3e. T.D. 2,574 ft.; 1,400 ft. W.I.H. S.D.
Sinclair Prairie Oil Co. No. 1 Lancaster Trust, C SW NE sec. 10-1-2e. T.D. 4,404 ft.; freeing stuck pipe.

Pushmataha County

Erle Halliburton et al No. 1 Bagwell, SW NE NE sec. 30-3s-15e. Drlg. 5,760 ft.

Stephens County

Jack Cohen No. 1 Pierce, NE NE NW sec. 24-2s-6w. Drlg. 1,770 ft.
Coline Oil Co. No. 1 Johnson, C SW SE SE NE sec. 1-2n-8w. T.D. 10,000 ft.; set 7-in. at 8,971 ft.; swbg. at 6,000 ft.; no oil.
Chas. Newsom No. 1 Pfile, SW cor. sec. 1-2s-7w. T.D. 3,551 ft.; S.D.O.
Ed Parsons No. 1 Blake, C SW NW sec. 22-2n-8w. Drlg. 5,255 ft.

Tillman County

Cavens et al No. 1 Southerland, SW SW NW sec. 35-4s-16w. T.D. 44 ft.; S.D.
Gulf Oil Corp. No. 1 Prichard, SE NW SE sec. 32-3s-16w. Arbuckle 5,715 ft., T.D.; D.&A.
Tom Walker No. 1 Bowman, SW SW NW sec. 10-4s-17w. S.D. 200 ft.

ARKANSAS

Columbia County

Hayner, Reaves & Hose No. 1 Brandon, SW NW SW sec. 34-11-13. Drlg. 2,866 ft.
Kerr-Lynn Oil Co. No. 1 Barnett, sec. 14-17-20. Drlg. 4,299 ft.
E. O. Olds No. 1 Dennis, NE SE SW sec. 4-17-21. Drlg. 3,905 ft.
Standard of La. No. 1 J. P. McKean, SW sec. 8-16-22w. T.D. 7,259 ft.; flowing and testing.
Tide Water-Seaboard Oil Co. No. 1 Crumpler, SW NE SW sec. 24-17-19w. Cg. 6,545 ft.

Miller County—Rodessa

F. W. Burford No. 3 Ahern, sec. 10-20-28. Comp.; flw. 15 B.P.H.; T.D. 6,088 ft.
Anding & Bird No. 4 Skipper, SW NW SW sec. 11-20-28. Comp.; flw. 16 B.P.H.. T.D. 6,103 ft.
F. W. Burford No. 4 Ahren, SE SE SW sec. 10-20-28. Drlg. 6,005 ft.
F. W. Burford No. 1-E A. A. Capps, sec. 13-20-28. 7-in. 5,982 ft.; T.D. 6,026 ft.
F. W. Burford No. 1-A J. O. Gerrald, NE cor. sec. 15-20-28. Drlg. 5,999 ft.
F. W. Buford No. 2-B G. G. Gerrald, sec. 15-20-28. Comp.; flw. 18 B.P.H.; T.D. 6,070 ft.
G. C. Grasty No. 1 Treadway, SW SE NE sec. 10-20-28. Comp.; flw. 33 B.P.H.; T.D. 6,148 ft.
H. L. Hunt No. 4 Womack, NE SE SE sec. 10-20-28. 7-in. 6,043 ft.; T.D. 6,086 ft.
H. L. Hunt No. 5 Womack, SW SW SE sec. 10-20-28. Drlg. 5,262 ft.
Kroll & Travis No. 1 Dickson, SW SE NW sec. 11-20-28. Comp.; flw. 20 B.P.H.. T.D. 6,169 ft.
Rodger Lacy No. 1 Sartor, SE W½ sec. 15-20-28. Crooked hole; P.B.
Rodger Lacy No. 2 Grogan, NE E½ W½ sec. 15-20-28. Drlg. 100 ft.
W. M. Layton No. 3 Terry, SE W½ W½ sec. 14-20-28. Drlg. 4,636 ft.
R. H. Long No. 1 Greer, SW NE SE sec. 10-20-28. Comp.; flw. 60 B.P.H.; T.D. 6,118 ft.
McClanahan et al No. 4 Capps, NE NE SW sec. 11-20-28. 7-in. cmtd. 6,075 ft.; on bttm.; tstg.
McClanahan et al No. 1 Easton, S½ NW SW sec. 12-20-28. Drlg. 2,000 ft.
McClanahan No. 1 T. J. Hopkins, SE SW NE sec. 11-20-28. Drlg. 5,888 ft.
McClanahan et al No. 2 T. J. Hopkins, C sec. 11-20-28. Fsg. for bit 3,633 ft.
McMurray No. 1-A Thomas, NW E½ W½ sec. 13-20-28. Drlg. 4,305 ft.
McMurray No. 2-B Thomas, SW SW SE sec. 12-20-28. Drlg. 3,862 ft.
J. R. Ostrom No. 1 J. O. Gerrald, NW E½ sec. 15-20-28. T.D. 6,079 ft.; tstg.
Parks et al No. 1 Gerrald, sec. 11-20-28. Drlg. 4,707 ft.
Skelly Oil Co. No. 1 Thomas, SW SE SW sec. 12-20-28. Drlg. 5,675 ft.
A. M. Sutton No. 1 Cross, SE cor. SE NE sec. 11-20-28. Drlg. 5,323 ft.
S. O. Thomason No. 1 Greer, SW SW NW sec. 11-20-28. Drlg. 4,717 ft.
Texas Canadian Oil Co. No. 1 Thomas, sec. 12-20-28. Drlg. 2,200 ft.

Miller County—Other

Odel Hinson No. 1 Montana Realty Co. O.W.D.D.; T.D. 5,235 ft.; P.B. to 7-in. csg. seat and prep. perf.

Pulaski County

A. L. Kitselman No. 2 A. L. Kitselman, Jr., SE SE SW sec. 2-1s-13e. S.D. 1,381 ft.

Union County—Schuler

E. M. Jones No. 2 Marine Oil Co., SW NW SE sec. 17-18-17. Drlg. 6,050 ft.
E. M. Jones No. 3 Marine Oil Co., NE NW SE sec. 17-18-17. Drlg.
E. M. Jones No. 4 Marine Oil Co., SE SW SE sec. 17-18-17. Drlg. 4,644 ft.
Lion Oil Ref. Co. No. 1-A M. D. Justiss; NE NW NE sec. 19-18-17. R.U. to D.D.
Lion Oil Ref. Co. No. 1 Marine Oil Co., NE SE SW sec. 17-18-17. Drlg. 3,920 ft.
Lion Oil Ref. Co. No. 4-B Edna Morgan, NW SW SE sec. 18-18-17. R.U.
Lion Oil Ref. Co. No. 3-B Edna Morgan, NE NW SE sec. 18-18-17. Drlg. 1,982 ft.
Lion Oil Ref. Co. No. 1-C D. and J. C. Morgan, NE SE SE sec. 18-18-17. R.U.
Marine Oil Co. No. 2 M. D. Justiss, sec. 18-18-17. Drlg. 3,858 ft.
Phillips Pet. Co. No. 1 E. Gan, SW SE NE sec. 18-18-17. Drlg. 7,182 ft.
Phillips Pet. Co. No. 1 Jennings, NW SW NE sec. 18-18-17. Drlg. 1,400 ft.
Alice Sidney Oil Co. No. 2 Morgan, SE NE SE sec. 18-18-17. O.W.D.D.; drlg. 7,253 ft.
Alice Sydney Oil Co. No. 3 Morgan, NW NE SE sec. 18-18-17. R.U.

Union County—Other

Ark. So. Oil Co. No. 1 Simmons, SE NW sec. 15-18-18. Drlg. 2,191 ft.
W. D. Winfield No. 2 Southern Kraft Corp., sec. 18-16-14. T.D. 2,728 ft.; 7-in. cmt. 2,727 ft.

LOUISIANA

NORTH LOUISIANA PROVEN

Caddo—Rodessa

F. W. Burford No. 1 Pitts, NW sec. 1-23-16. T.D. 6,010 ft.. tstg.
F. W. Burford No. 1 R. A. Terry, NW E½ sec. 2-23-16. Drlg. 5,787 ft.
F. W. Burford No. 4 Terry, SE NE sec. 2-23-16. Drlg. 3,830 ft.
F. W. Burford No. 1 U. S. Govt., NE SE SW sec. 6-23-16. Drlg. 5,570 ft.
Gulf Ref. Co. No. 2 Campbell, C sec. 4-23-16. Comp.; flow 221 B.P.D.; T.D. 6,061 ft.
Magnolia Pet. Co. No. 4 Mary S. Atkins, SW SE sec. 7-23-15. T.D. 6,060 ft.; S.D.; W.O.
Magnolia Pet. Co. No. 2 G. W. Hardy, NW SW sec. 1-23-16. Drlg. 1,950 ft.
Standard Oil of La. No. 1 Mrs. Alice N. Gibson, NW NE SW sec. 10-23-16. Drlg. 4,756 ft.
Standard Oil Co. No. 3 McCoy, NE cor NE NW sec. 10-23-16. Comp.; flow 30 B.P.H.; T.D. 5,959 ft.
Union Prod. Co. No. 6 Starke, SW cor. sec. 8-23-16. T.D. 5,860 ft.; fsg. for D.S.
G. H. Vaughn No. 1 J. G. Yates, NW cor. sec. 2-23-16. Drlg. 5,991 ft.

N. LOUISIANA WILDCATS

Bienville Parish

Gulf Ref. Co. No. 1 Goodpine, sec. 25-14-8. Drlg. 5,111 ft.
H. L. Hunt and Seaboard No. 1 Federal Ld. Bk., SW sec. 10-16-16. Drlg. 6,699 ft.

Bossier Parish

Premier Inv. Co. No. 1 McDade, SE SW NE sec. 28-19-11. Drlg. 546 ft.

OKLAHOMA

Week Ending November 6

NORTHERN OKLAHOMA

Beckham County

Mid-American Oil Co. No. 1-A Biscoe, SW cor. sec. 28-8-22w. Granite Wash; S.O. 2,213-20 ft.; fsg.

Caddo County

Indian Terr. Illum. Oil Co. No. 1 Dome-Bo, C NE SE sec. 29-6-10w. T.D. 5,255 ft.; 9-in. csg. parted; S.D.O.

Cleveland County

Harper-Turner No. 1 Pollock, C W½ NW NW sec. 13-9-2w. Drlg. 6,225 ft.

Creek County

M. W. Mosier et al No. 1 Holcomb, SE SW NW sec. 19-18-8. T.D. 3,018 ft.; P.B. 3,015 ft.; swedging csg.

Garfield County

H. R. Hollenback et al No. 1 Clark, NW cor. sec. 34-21-6w. Drlg. 4,400 ft.

Garvin County

Carter Oil Co. No. 1 Potts, C E½ SE NW sec. 36-1n-3w. Drlg. 3,647 ft.
S. C. D. Edwards No. 1 Clark, NE cor. sec. 16-3n-3e. Drlg. 2,460 ft.

Grady County

Doyle Pet. Co. No. 1 Huffine, NW NW SE sec. 30-5-8w. Drlg.
Gulf Oil Corp. No. 1 Thomas, SW NW NW sec. 14-4-5w. Drlg. 8,719 ft.

Greer County

J. I. Medlin et al No. 1 Broudie, NW cor. sec. 5-6n-20w. T.D. 90 ft.; S.D.

Hughes County

Burke-Greis Oil Co. No. 1 Rhea, SW SW SE sec. 14-10-9. T.D. 3,432 ft.; run. 5-in.
Phillips Pet. Co. No. 1 Becker, NE NW SW sec. 8-5-10. Set 9-in. 4,414 ft.; T.D. 4,425 ft.; 19,700,000 ft. gas; to deepen.
Pure Oil Co. No. 1 Rogers, SE SE NE sec. 18-8-12. Drlg. 4,250 ft.

Kay County

E. W. Jones et al No. 1 Dorse, SE SW NW sec. 25-26-1w. Drlg. 516 ft.
E. J. Shaffer et al No. 1 McKee, NE NW sec. 20-28-1w. Drlg. 2,327 ft.

Kiowa County

Hughes & Reese No. 1 Fultz, SE cor. sec. 10-6-18w. S.O. 968-74 ft.; U.R. 8¼-in.

Lincoln County

C. L. Carlock No. 1 Young, C N half NW NW sec. 23-15-5. T.D. 3,880 ft.. S.D. for wtr.
Riley & Talbot et al No. 1 Weidler, NW SW NW sec. 20-17-2e. 1st. Wilcox 4,898 ft.; coring below 4,991 ft.

Logan County

Texas Co. No. 1 Roper, C W½ SW SE sec. 22-15-1e. Drlg. 3,570 ft.

Okfuskee County

F. W. Merrick No. 1 Mackey, NE NE SW sec. 29-11-10. 2nd Wilcox 4,052 ft.; T.D. 4,062 ft.; D.&A.
Riverland Oil Co. No. 1 Board, NE NW SE sec. 10-13-10. Set 6-in. 2,788 ft.; T.D. 2,840 ft.

Pawnee County

H. R. Hollenbach et al No. 1 Clark, NW cor. sec. 34-21-6w. Drlg. 4,120 ft.

Pittsburg County

Okla. Dist. Oil Co. No. 1 Beeler, NE NE SW sec. 7-7-14. Drlg. 5,518 ft.
Phillips Pet. Co. No. 1 Gilcrease, NW NW SE sec. 16-7-12. Drlg. 4,932 ft.

Pontotoc County

Boettcher O. & G. Co. No. 1 Gann, SE NW NE sec. 25-4n-7e. T.D. 4,347 ft.; junked hole; D.&A.
Kerlyn Oil Co. No. 1 Pratt, SW SE NE sec. 6-4-4e. Wilcox 2,290-2,355 ft.; T.D.; rng. Schlumberger.
Norbia Oil Co. No. 1 McBride, NE NE SW sec. 10-2n-5e. Loc.; T.A.
Papoose Oil Co. et al No. 1 Jones, NW SE NW sec. 2-4-5. Viola 2,595 ft.; T.D. 2,840 ft.; run Schlumberger; S.D.O.
Union Dev. Co. No. 1 Abbott, SW NW NE sec. 34-3-6. T.D. 3,320 ft.; drill pipe stuck. S.D.

Pottawatomie County

Hightower No. 1 Baker, SE SE NW sec. 27-6-3e. Tools moved out; S.D.

Seminole County

E. W. Jones et al No. 1 Belford, NE SE NE sec. 9-9-8. Drlg. 4,597 ft.
Stanolind O. & G. Co. and Amerada Pet. Corp. No. 1 Salina, SE NE NW sec. 4-5-6. T.D. 3,317 ft.; P.B. 3,186 ft.; to test Hunton L.

Texas County

Hagey et al No. 1 Becker, C NE sec. 4-1n-13ecm. Spray S.W. 2,910 ft.; T.D. 3,010 ft.; to P.B.
Hagey et al No. 1 Peck, C NE sec. 6-1n-13ecm. Set 7-in. 2,766 ft.; W.O.C.

Triangle Drlg. Co. No. 1-A Schuler Est., SE NW sec. 13-17-12. Comp.; flw. 110 110 B.P.D.; T.D. 3,118 ft.

Caddo Parish

W. D. Chew No. 3 Spell, NE SW SE sec. 29-21-15. Drlg. 1,295 ft.

Mrs. O. P. Clement No. 1-B Caddo Lvy. Bd., NE sec. 5-20-16. Drlg. 1,400 ft.

D. C. R. Oil Co. No. 1 Dickinson, SW SW NW sec. 15-19-14. Comp.. flw. 100 B. P.D.; T.D. 2,465 ft.

Driscoll Jt. No. 1 Muslow, SE NW NE sec. 4-20-15. Drlg. 1,000 ft.

W. Dromgoole No. 1 School Bd., SE NW sec. 16-19-14. Drlg. 1,055 ft.

A. R. Hancock No. 1 Heipman, NE SW sec. 6-21-16. Drlg. 82 ft.

W. H. Harrison No. 2 Shoreline Crystal, SE NW NE sec. 23-21-16. R.U.

Magnolia Pet. Co. No. 27 Robertshaw, sec. 29-21-15. W.O.S.R.

La. Oil Prod. Co. No. 11-B Muslow, sec. 4-20-15. T.D. 2,213 ft.; W.O.S.R.

La. Oil Prod. Co. No. 13-B Muslow, SE NW SW sec. 4-20-15. Comp. pump 150 B.P.D.; T.D. 2,146 ft.

O. O. Olsen No. 1 R. T. Sharp, W½ NW sec. 15-18-16. Drlg. 4,432 ft.

Frank Perkins No. 2-A Stiles, SW NW SW sec. 33-21-16. T.D. 1,858 ft.; S.O.; S.D.; arg. D.D.

Prairie River Synd. No. 1 Hutchinson, SW NW sec. 15-15-12. S.D. 9,141 ft.

Sam M. Richardson No. 1 Sentell, SW E½ sec. 9-19-14. T.D. 2,460 ft.; W.O.S.R.

J. J. Shulman No. 1 Hobbs, NW sec. 28-21-15. Drlg. 850 ft.

Simplex Oil Co. No. 12 Glassell, sec. 10-20-15. Drlg. 2,015 ft.

Stanolind O. & G. Co. No. 130 Dillon, NW SW sec. 13-20-15. T.D. 1,700 ft.; acid.

Surf-Maji Oil Co. No. 3 Self, SE sec. 10-20-15. Comp.; pump 175 B.P.D.; T.D. 2,193 ft.

Claiborne Parish

Atlantic Refg. Co. No. 2-B Tatum, E½ NW SW sec. 32-21-4. Loc.

Atlantic Ref. Co. No. 2-C Patton, E½ SW SE sec. 29-21-4. Drlg. 3,999 ft.

R. L. Bauman No. 2 C. S. L. Patton, SW SW NE sec. 1-20-5. Comp.; flw. 97 B. P.H.; T.D. 3,368 ft.

Crescent Drlg. Co. No. 1 Fowler, E½ SW NW sec. 33-21-4. Drlg. 2,550 ft.

E. W. Gill No. 1 English, S½ NE SW sec. 29-21-4. T.D. 5,150 ft.; rg. csg.

Harry Hanbury No. 1-E R. Vaughn, S½ NE SE sec. 25-21-5. R.U.

T. L. James No. 1 Baker, sec. 25-21-5 T.D. 5,222 ft.; comp.; pmp. 135 B.P.D.

W. L. McClanahan No. 1 J. T. Lewis, W½ SW SE sec. 25-20-7. Drlg. 2,159 ft.

A. O. Olsen No. 1 English, E½ SE SE sec. 29-21-4. Drlg. 820 ft.

A. O. Olson No. 1 W. H. Patton, S½ SE SE sec. 26-21-5. Comp.; flw. 35 B.P.H.; T.D. 5,273 ft.

A. O. Olsen No. 5-A Patton, NE SW sec. 30-21-4. Drlg. 1,100 ft.

C. R. Schuster No. 1 S. Lloyd, SW SW sec. 2-20-5. R.U.

Sloan & Zook No. 2-C S. L. Patton, sec. 1-20-5w. Drlg. 4,130 ft.

Sloan & Zook Co. No. 4 W. H. and M. Patton, sec. 1-20-5. 7-in. 5,292 ft.; T.D. 5,292 ft.; tstg.

A. O. Olson No. 4-A T. F. Patton, N½ SE SW sec. 30-21-5. Comp.; flw. 60 B.P.H.; T.D. 5,197 ft.

Tippett Drlg. Co. No. 2 C. S. L. Patton, sec. 1-20-5. 10-in. cmtd. 725 ft.

Union Prod. Co. No. 2 Brownfield, sec. 5-19-5; O.W.D.D., Sugar Creek field. Drlg. 7,041 ft.

G. H. Vaughn No. 2 Eppinger, N½ SW SW sec. 29-21-4. Drlg. 900 ft.

LaSalle Parish

T. & J. Inc. No. 2 Tullos, SE NE sec. 26-10-1e. R.U.

Concordia Parish

Coastal Mineral & Dev. Co. No. 1 Winsten, sec. 23-7-9e. Drlg. 2,255 ft.

De Soto Parish

Clear Lake Oil Co. No. 1 J. A. Woolums NW sec. 29-12-12. T.D. 2,667 ft.; S.O.; S.D.; wt. csg.

Kingston Oil Co. No. 1 Scott, SE NE sec. 32-14-13. T.D. 2,765 ft.; 5-in. 2,740 ft.. tstg. S.O.

Lincoln Parish

Gulf Ref. Co. No. 1 M. Patton, C sec. 6-20-4. Drlg. 2,665 ft.

Ludel Oil Corp. No. 1 Gill, NE NE NW sec. 36-20-2w. T.D. 5,318 ft.; S.D.

Magnolia Pet. Co. No. 1-B F. Corbin, N½ NW NW sec. 5-20-4. Drlg. 3,200 ft.

E. H. Moore, Inc. No. 1 Arcadia Comm. Bk., C NW sec. 22-18-5. Drlg. 6,005 ft.

Red Iron Drlg. Co. No. 2 T. F. Patton, NW SW NE sec. 6-20-4. Drlg. 1,260 ft.

Red River Parish

Arkansas Fuel Co. No. 1 Frankland Realty Co., NW sec. 20-11-9. R.U.

J. F. Lent et al No. 1 Chicago Coal & Ld. Co., SE sec. 17-13-11. R.U.

Sabine Parish

Fox & Phillips No. 1 Cook Ld. Co., SW SE NW sec. 1-9n-12w. Drlg. 1,975 ft.

Gold Oil Co. No. 1 Darby, N½ SE sec. 21-7-11. T.D. 2,586 ft.; tstg.

Hunter Co. No. 1 H. L. Bowman Co., NW cor. sec. 13-7-17. Comp.; flw. 20 B.P.H.; T.D. 2,137 ft.

Major Oil Co. No. 1 Graham, SE NE NE sec. 19-9-13. Drlg. 150 ft.

Remine et al No. 1 4-L Co., SW SW sec. 7-5-12. Drlg. 3,586 ft.

Tensas Parish

H. M. Jones No. 2 Chicago Mill & Ld. Co., NE SW sec. 31-12-10e. R.U.

Union Parish

Joe Modisett No. 1 Frost Lbr., sec. 14-21-1e. Drlg. 4,170 ft.

Webster Parish

V. L. Foster No. 2 J. M. Mixon, SE sec. 21-21-10. Drlg. 7,078 ft.

Magnolia Pet. Co. No. 4 Aarnes-Cox, NW sec. 22-21-10. Drlg. 8,408 ft.

Magnolia Pet. Co. No. 1 Crichton Hrs., NE NW sec. 33-21-10. Drlg. 4,595 ft.

Magnolia Pet. Co. No. 7 Marshall, SW SE sec. 21-21-10. Drlg. 600 ft.

Ohio Oil Co. No. 2 Bodcaw Acct. 4, SW SE NW sec. 24-21-10. Drlg. 825 ft.

Ohio Oil Co. No. 48 Bodcaw Acct. 2, SE sec. 15-21-10. Drlg. 850 ft.

Ohio No. 1 S. P. D. Coyle and W. Cox, SW SW SE sec. 23-21-10. 7-in. 8,065 ft.; T.D. 8,119 ft.; W.O.C.S.

Ohio Oil Co. No. 2 Warren Cox, SE sec. 23-21-10. Drlg. 1,670 ft.

A. G. Oliphant et al No. 1 Banks, NE NE sec. 34-21-10. 7-in. 8,122 ft.; T.D. 8,187 ft.; W.O.C.S.

Ohio Oil Co. No. 1 D. W. Merritt, SW cor. sec. 14-21-10. Comp.. flw. 364 B.P.D.; T.D. 8,305 ft.

Standard Oil Co. of La. No. 7 Mrs. M. F. Davis, NE NE NW sec. 23-21-10. Drlg. 7,678 ft.

Standard Oil Co. of La. No. 2-B Mrs. M. E. Gray, NE NE NW sec. 26-21-10. Drlg. 7,673 ft.

United Gas No. 6 Tillman, NE sec. 28-21-10. Drlg. 5,840 ft.

Woodley Pet. Co. No. 2-B L. C. Cox. 7-in. 8,098 ft.; comp.; flw. 376 B.P.D.; T.D. 8,140 ft.

Woodley Pet. Co. No. 5-B M. E. Gray, sec. 27-21-10. Drlg. 4,461 ft.

SOUTH LOUISIANA FIELDS

Abbeville—Vermilion Parish

Continental Oil Co. No. 1 Brookshire, sec 66-12s-3e. T.D. 11,909 ft.; P.B. 11,109 ft.; P.B. 7,895 ft.; perf. csg. 7,884-90 ft.; I.P. 350 bbls. fluid per day, 5% wash wtr., balance 41.5-grav. oil.

Anse La Butte—St. Martin Parish

Anse La Butte Oil Corp. No. 1 Billeand, sec. 117-9s-5e. T.D. 832 ft.; 7-in. csg. 790 ft.; swb. S.W.; cmt. off bttm.; W. O.C.

Crusader Pet., Inc., No. 1 Central Oil Co., sec. 86-9s-5e. 10¾-in. csg. 465 ft.; drlg. sh. 1,315 ft.

Bay St. Elaine—Terrebonne Parish

F. J. LeBlanc No. 2 Wurzlow, sec. 17-22s-18e. S.D. 910 ft.

Texas Co. No. 15 State, sec. 20-22s-18e. Drlg. sh. 3,169 ft.

Bayou Blue—Iberville Parish

Humble O. & R. Co. No. 5-A Wilberts, sec. 75-9s-10w. Drlg. sdy. sh. 429 ft.

Bayou Cocotris—Terrebonne Parish

Shell Pet. Corp. No. 3-B Realty, sec. 18-17s-15e. 16-in. csg. 117 ft.; drlg. sh. 8,-783 ft.

Bayou De Allemands—St. Charles Parish

Amerada Pet. Corp. No. 1 St. Charles Ld. Co., sec. 38-15s-20e. 10¾-in. csg. 2,698 ft.; core sd. show oil 6,924-29 ft.

Big Lake—Cameron Parish

Union Sulphur Co. No. 1 P. J. Hebert, sec. 18-12s-8w. 6⅝-in. csg. 8,441 ft.; T. D. 9,289 ft.; D.S. stuck; P.B.; sdtrk. drlg. sh. 8,471 ft.

Union Sulphur Co. No. 2 J. O. Hebert, sec. 18-12s-8w. Core sd. show oil 8,442-63 ft.; coring ahead 8,517 ft.

Black Bayou—Calcasieu Parish

Shell Pet. Corp. No. 36 Watkins. Drlg. L. (No report.)

Bosco—Acadia Parish

Superior Oil Co. No. 1 J. L. Larcade, sec. 64-8s-3e. T.D. 8,894 ft.; abd.

Superior Oil Co.-Pure Oil Co. No. 5 Larcade, sec. 35-8s-3e. T.D. 10,216 ft.; fsg.

Caillou Island—Terrebonne Parish

Texas Co. No. 52 State, sec. 19-23s-20e. T.D. 3,768 ft.; 7-in. csg. 3,743 ft.; I.P. 439 B.P.D., ⅝-in. ck.

Cameron Meadows—Cameron

Burton-Sutton Oil Co. No. 19 Sch. Ld., sec. 16-14s-13w. Drlg. sh. 5,493 ft.

Magnolia Pet. Co. No. 21 Cameron Meadows, sec. 21-14s-13w. 13⅜-in. csg. 1,-173 ft.

Charenton—St. Mary Parish

Pan American Prod. Co. No. 1 Dolph, sec. 36-13s-9e. T.D. 7,185 ft.; 7-in. csg. 6,904 ft.; perf. csg. 6,838-46 ft.. swbg.; no results.

Pan American Prod. Co. No. 2 South Coast Corp., sec. 31-13s-9w. T.D. 7,228 ft.; 7-in. csg. 6,556 ft.; perf. 6,476-94 ft.; tested S.W.; squeeze off perf.

Choctaw—Iberville Parish

Standard Oil Co. No. 10 Grove, sec. 52-9s-11e. T.D. 5,303 ft. in salt; D.S. stck. P.B. 4,650 ft.; T.D. 5,075 ft.; sdtrkd. while rmg.; top salt 5,188 ft.; S.D. 5,-814 ft.; salt.

Louisiana Crusader Oil Co. No. 1 E. B. Schwing, sec. 29-8s-11e. Loc.

Darrow—Ascension Parish

Humble O. & R. Co. No. 16 Community, sec. 29-10s-2e. Core sh. 5,788 ft.

Kiva Oil Co. No. 1 Duplessis, sec. 69-10s-2w. R.U.

Dog Lake—Terrebonne Parish

Texas Co. No. 18 State, sec. 5-22s-16e. T.D. 7,606 ft.; P.B. 1,564 ft.; drlg. sh. and L. 6,577 ft.

Edgerly—Calcasieu Parish

Crusader Pet., Inc., No. 1 Miller Bros., sec. 27-9s-11w. 7-in. csg. 6,078 ft.; T.D. 6,523 ft.; 5-in. csg. 6,215 ft.; W.O.C.

Four Isle—Terrebonne Parish

Texas Co. No. 9 L.L.&E., sec. 24-21s-16e. T.D. 8,553 ft.; P.B. 3,881 ft.; sdtrk.; drlg. sh. 4,007 ft.

Garden Island—Plaquemines Parish

Texas Co. No. 24 State, sec. 37-23s-33e. T.D. 5,596 ft.; salt; P.B. 3,464 ft.; drlg. sd. 5,010 ft.

Gillis—Calcasieu Parish

Union Sulphur Co. No. 7 Kaufman, sec. 13-9s-8w. T.D. 7,079 ft.; 5-in. csg. 7,052 ft.; swbd. S.W.; P. B. 6,898 ft.; swbd. S.W.; fsg. for screen; P.B. 7,057 ft.; trying to sdtrk.

Union Sulphur Co. No. 2 Mary McIvor, sec. 14-9s-8w. Drlg. sdy. sh. 6,222 ft.

Hackberry—Cameron Parish

W. T. Burton No. 3 Lewis, sec. 22-12s-10w. R.U.

W. T. Burton No. 1 Porter Ellender, sec. 27-12s-10w. T.D. 5,578 ft.; 7-in. csg. 4,-950 ft.; P.B. 4,910 ft.; perf. csg. 4,891-4,907 ft.. swbg.

M. P. O'Meara No. 1 Rigmaden heirs, sec. 22-12s-10w. Drk.

Stanolind O. & G. Co. No. 6 Duhon, sec. 22-12s-10. Drlg. sh. 4,593 ft.

Stanolind O. & G. Co. No. 8 Carter & Sweeney, sec. 22-12s-10w. R.U.

Stanolind O. & G. Co. No. 10 Carter & Sweeney, sec. 22-12s-10w. Drk.

Stanolind O. & G. Co. No. 7 Duhon, sec. 22-12s-10w. 10¾-in. csg. 1,402 ft.; drlg. sh. 3,260 ft.

Stanolind O. & G. Co. No. 26 Gulf Ld., sec. 22-12s-10w. 10¾-in. csg. 1,644 ft.; T.D. 4,513 ft.; reaming.

Stanolind O. & G. Co. No. 27 Gulf Ld., sec. 22-12s-10w. R.U.

Texas Co. No. 23-B State, sec. 12-12s-9w. T.D. 5,448 ft.; P.B. 2,409 ft.; T.D. 7,274 ft.; P.B. to sdtrk.; coring oil sd. 7,466 ft.

Lockport-Cameron Parish

Magnolia Pet. Co. No. 35 Miller, sec. 9-10s-9w. Drlg. sh. 6,553 ft.

Jeanerette—St. Mary Parish

Herton Oil Co. No. 1 Teche Sugar Co., sec. 58-13s-8e. R.U.

Jennings—Acadia Parish

Frank W. Bennett et al No. 1 Brethern and Christ Church, sec. 41-7s-2w. T.D. 7,107 ft.; D.S. stuck; shot: P.B. 5,586 ft.; sdtrkd at 5,740 ft.; drlg. sdy. sh. 6,170 ft.

W. T. Burton No. 4 Roboria, sec. 41-9s-3w. Drlg. sdy. sh. 6,561 ft.

Crusader Pet., Inc., No. 1 E. H. Grace, sec. 45-9s-2w. T.D. 3,641 ft.; 7-in. csg. 3,602 ft.

Glassell & Glassell No. 2 McFarland, sec. 41-9s-2w. T.D. 6,975 ft.; 7-in. csg. 6,770 ft.

Glassell & Glassell No. 4 Trushell, sec. 42-9s-3w. T.D. 3,476 ft.; S.D.

Gulf Ref. Co. No. 39 Arnaudit, sec. 47-9s-2w. Spd.

Jolly Pet. Co. No. 2 McFarlain, sec. 41-9s-2w. Bldg. drk.

Ladak Oil Co. No. 2 Jennings-Clement, sec. 46-9s-2w. T.D. 2,055 ft.; 6-in. csg. 2,055 ft.; I.P. 250 B.P.D., ¼-in. ck.

M. P. O'Meara No. 1 Moresi, sec. 41-9s-2w. R.U.

Jolly Pet. Co. No. 5 Jennings-Haywood, sec. 46-9s-2w. Drk.

Reiter Foster Oil Co. No. 2 Crusel, sec. 42-9s-2w. Drlg. sdy. sh. 3,908 ft.

Superior Oil Co. No. 1 Julis Clement, sec. 46-9s-2w. R.U.

Shell Pet. Corp. No. 3 Community, sec. 40-9s-2w. Drlg. sdy. L. 5,232 ft.

Stanolind O. & G. Co. No. 19 Houssiere-Latrelle, sec. 47-9s-2w. Drlg. sdy. sh. 4,585 ft.

Superior Oil Co. No. 8 Leckelt, sec. 42-9s-2w. Drlg. sdy. sh. 5,915 ft.

Superior Oil Co. No. 7 Leckelt, sec. 42-9s-2w. T.D. 4,743 ft.; cmtd.; fsg.; drlg. out cmt.

Superior Oil Co. No. 4 Jennings-Haywood sec. 41-9s-2w. T.D. 6,500 ft.; 7-in. csg. 6,314 ft.; tstd. wet gas.

Superior Oil Co. No. 3 Moresi, sec. 41-9s-2w. T.D. 6,748 ft.; stuck D.S.; sdtrkg. 5,038 ft.; drlg. sh. 6,509 ft.

Lafitte—Jefferson Parish

Texas Co. No. 7 L.L.E., sec. 20-17s-24w. Drlg. sh. 9,634 ft.

Texas Co. No. 8 Rigolet, sec. 29-17s-24e. 13⅜-in. csg. 1,923 ft.; drlg. sdy. sh. 4,612 ft.

Texas Co. No. 1 State-Bayou Normer, sec. 28-17s-24e. T.D. 12,115 ft.; D.S. stuck; P.B. 9,637 ft.; perf. csg. to test.

Lake Barre—Terrebonne Parish

Texas Co. No. 141 State, sec. 40-21s-19e. S.D. 3,744 ft.; sdtrkd.; T.D. 3,641 ft.; P.B. and sdtrkd.; drlg. sdy. sh. 3,578 ft.

Lake Hermitage—Plaquemines Parish

Gulf Ref. Co. No. 7 Lafourche, sec. 1-18s-25e. 7-in. csg. 8,074 ft.; drlg. sdy. sh. 8,524 ft.

Lake Pelto—Terrebonne Parish

Texas Co. No. 13 State, sec. 8-23s-18e. Drlg. sd. and sh. 6,160 ft.

Lake Washington—Plaquemines Parish

Humble O. & R. Co. No. 25 Cockrell, sec 35-20-26e. T.D. 6,357 ft.; recvd. 14 stands P.L.O.; 9⅝-in. csg. 5,263 ft.; drlg. plug.

Lockport—Calcasieu Parish

Magnolia Pet. Co. No. 35 Miller, sec. 9-10s-9w. Drlg. sh. 6,553 ft.

Lake Long—Lafourche Parish

Fohs Oil Co. No. 2 State, sec. 65-17s-19e. R.U.

Fohs Oil Co. No. 3 State, sec. 65-17s-19e. 10¾-in. csg. 2,743 ft.; T.D. 9,539 ft.; sd. 9,517-33 ft.

Leesville—Plaquemines Parish

Texas Co. No. 63 Leesville, sec. 27-12s-22e. Bldg. drk.

Lirette—Terrebonne Parish

Humble O. & R. Co. No. 1 Frank Wurzlow sec. 6-19s-19e. Drlg. sh. 1,565 ft.

New Iberia—Iberia Parish

Wm. Hellis No. 3 Schwing, sec. 57-12s-7e. T.D. 5,019 ft.; P.B. and sdtrkd.; salt 5,-509 ft.; P.B. 2,650 ft.; T.D. 3,949 ft.; 7-in. csg. 3,920 ft.; L. 4,524 ft.. T.D. 4,552 ft.; P.B.; sdtrk.; drlg. sh. 3,190 ft.

Texas Co. No. 3 Bryant, sec. 25-12s-7e. R.U.

Wm. Hellis No. 9 Bernard, sec. 54-12s-7e. T.D. salt 5,171 ft.; P.B. and sdtrkd.; sd.&sh. 4,538 ft.; T.D. 4,661 ft.; salt; P.B.; sdtrk. drlg. sh. 4,168 ft.

Wm. Hellis No. 10 Bernard, sec. 54-12s-7e. R.U.

Wm. Hellis No. 11 Bernard, sec. 54-12s-7e. T.D. 3,974 ft.; salt; sdtrk.; drlg. 1,500 ft.

Wm. Hellis No. 6 Bullock-Burke, sec. 25-12s-7e. T.D. 4,817 ft.; P.B. and sdtrkd.; T.D. 4,769 ft.; P.B. 2,700 ft.; salt 4,463 ft.; P.B. 3,955 ft.; 7-in. csg. 3,890 ft.

Texas Co. No. 1 Burke, sec. 56-12s-8e. Drlg. wtr. sd. 647 ft.

Texas Co. No. 4 Duke, sec. 26-2s-7e. Drlg. sh. 4,607. (No report.)

North Crowley—Acadia Parish

Humble O. & R. Co. No. 1 Antonohlenforst, sec. 45-8s-1e. T.D. 8,117 ft.; S.O. and S.W. on D.S.T.; 7-in. csg. 8,117 ft.; perf. 8,101-05 ft.. I.P. 32 B.P.H., ¼-in. ck.

Humble O. & R. Co. No. 1 H. J. Habetz, sec. 45-8s-1e. Dig. pits.

Humble O. & R. Co. No. 1 Habetz, sec. 3-9s-1e. Drlg. sdy. sh. 1,518 ft.

Humble O. & R. Co. No. 1 L. Laumbrecht, sec. 4-9s-1e. Drlg. sdy. sh. 5,-728 ft.

Roanoke—Jeff Davis Parish

Humble O. & R. Co. No. 9-B Devilbiss, sec. 11-9s-4w. Drlg. sh. 7,502 ft.

Superior Oil Co. No. 1 Ferguson, sec. 13-9s-4w. R.U.

Sorrento—Ascension Parish

Sorrento Oil Co. No. 1 L. L. Barnard et al, sec. 16-10s-4e. R.U.

South Elton—Jeff Davis Parish

Stanolind O. & G. Co.-Amerada Pet. Corp. No. 3-B Calcasieu Natl. Bank, sec. 27-7s-3w. R.U.

South Jennings—Jeff Davis Parish

Loffland Bros. No. 1 Fontenot, sec. 16-10s-3w. T.D. 8,751 ft.; run Schlumberger; cored sd. show. oil 8,671-8,738 ft.

Starks—Calcasieu Parish

Capital Oil Co. No. 1 Lutcher-Moore, sec. 24-9s-13w. R.U.

Lutcher Moore No. 3 fee, sec. 19-8s-12w. Drlg. rock 3,068 ft.

Turnbull et al No. 2 Industrial Lbr. Co., sec. 19-9s-12w. T.D. 4,861 ft.; perf. csg. 4,635-45 ft.; swbg.; show some gas, no oil; abd.

Sulphur—Calcasieu Parish

Union Sulphur Co. No. 853 fee, sec. 20-9s-10. T.D. 1,039 ft.; run 10¾-in. csg.

Union Sulphur Co. No. 852 fee, sec. 29-9s-10w. Drlg. sd. 2,905 ft.

Union Sulphur Co. No. 851 fee, sec. 29-9s-10w. Drlg. sh. 2,694 ft.

St. Martinsville—St. Martin Parish

Tide Water Oil Co. No. 1-B Smedes, sec. 18-11s-6e. T.D. 8,925 ft.; heaving sh.

Valentine—Lafourche Parish

Pan American Prod. Co. No. 10 Harang, sec. 7-17s-20e. T.D. 6,977 ft.; P.B. 3,-000 ft.; T.D. 6,361 ft.; W.O.C.

Pan American Prod. Co. No. 12 Harang, sec. 7-17s-20e. Drlg. sd. and sh. 5,105 ft.

Pan American Prod. Co. No. 13 Harang, sec. 8-17s-20e. Spd.

Venice—Plaquemines Parish

Tide Water Oil Co. No. 4 Manhattan Fruit Co., sec. 26-21s-30e. Core oil sd. 7,155 ft.

Vinton—Calcasieu Parish

Katina Oil Co. No. 2 Vincent, sec. 34-10s-12w. T.D. 4,140 ft.; sdtrkd.; T.D. 3,215 ft.; 7-in. csg. 3,215 ft.; swbd. S.W.; plg. screen; pulled drk. in; rebuilding.

Superior Oil Co. No. 1 Gray, sec. 4-11-12w. 7⅝-in. csg. 3,907 ft.; drlg. sd.&sh. 6,647 ft.

Vinton Pet. Co. No. 23 Vincent, sec. 34-10s-12w. T.D. 3,256 ft.; 5-in. csg. 3,-256 ft.; perf. csg. 2,988-3,008 ft.; I.P. 35 B.P.D.; pumping.

White Castle—Iberville Parish

T. D. Humphray No. 1 E. B. Adams, sec. 1-11s-12e. S.D. 6,067 ft.; P.B. and sdrkd.; drlg. sdy. sh. 6,217 ft.

Shell Pet. Corp. No. 5 Shingle, sec. 12-11s-12e. 10¾-in. csg. 1,400 ft.; T.D. 6,-444 ft.; I.P. 641 B.P.D., ¼-in. ck.

S. LOUISIANA WILDCATS

Acadia Parish

H. E. Dalton No. 1 Setting, sec. 17-7s-1w.

T.D. 5,106 ft.; P.B. to approx. 500 ft.; drlg. sh. 2,610 ft.
Gulf Oil Corp. No. 1 Euclia Broussard, sec. 49-10s-2w. Drlg. sh. 7,192 ft.
Humble O. & R. Co. No. 1 R. A. Sarver sec. 35-10s-1e. T.D. 9,526 ft.; rmg.; 9⅝-in. csg. 7,550 ft.
Magnolia Pet. Co. No. 1 Duson, sec. 14-8s-2w. Drlg. sh. 7,561 ft.
T. S. Markley No. 1 Daigle, sec. 19-7s-2e Drlg. sh. 7,327 ft.

Calcasieu Parish

D. & D. Oil Co. No. 2 Lutcher-Moore, sec 1-8s-13w. T.D. 8,340 ft.; run 9⅝-in. csg drlg. plug; csg colpsd; T.D. 8,579 ft.; 1,747 ft. of 7-in. csg. cmtd 8,579 ft.; to core ahead.
Federal Pet. Co. No. 1 Sabine Tram Co., sec. 25-18s-14w. 10¾-in. csg. 1,981 ft.; drlg. sh. 6,210 ft.
Union Sulphur Co. No. 1 J. A. Bel, sec. 10-10s-10w. 10¾-in. csg. 1,216 ft.; drlg. sd.&L. 7,568 ft.
Wheeler Oil Corp. No. 2 Sch. Ld., sec. 16-9s-7w. R.U.

Cameron Parish

Humble O. & R. Co. No. 1 Miami Corp., sec. 8-14s-5w. 20-in. pipe set 188 ft.; drlg. sh. 7,425 ft.

Cameron Parish—Gulf of Mexico

Superior Oil Prod. Co. et al No. 1 State Gulf of Mexico, 3,800 ft. W, 6,200 ft. S of SE cor. of irregular sec. 4-15s-8w 10¾-in. csg. 1,157 ft.; drlg. sdy. sh. 4,670 ft.

East Baton Rouge Parish

Cavalier Oil Co. No. 1 Elliott, sec. 3-9s-2e. T.D. 6,127 ft.; D.S. stuck.

Evangeline Parish

Schlicher Prod. Co. No. 1 J. A. Perkins sec. 35. Top salt 4,924 ft.; drlg. salt 4,924 ft.

Iberia Parish

Texas Co. No. 2-B Vermilion Bay, sec. 20-16s-5e. Drlg. sh. 7,848 ft.

Jefferson Parish

Triangle Oil Co. No. 1 Conroe, sec. 128 12s-11e. T.D. 3,752 ft.; D.S. stuck.

Jefferson Davis Parish

Continental Oil Co. No. 1 Faye, sec. 31-10s-3w. 10¾-in. csg. 1,999 ft.; drlg. sh. 6,700 ft.
Humble O. & R. Co. No. 1 T. S. Stegall, sec. 20-9s-5w. 13⅜-in. csg. 2,032 ft.
Union Sulphur Co. No. 1 Calcasieu National Bank, sec. 12-9s-6w. Drlg. rock 7,673 ft.

Lafourche Parish

Amerada Pet. Corp. No. 1 South Coast Corp., sec. 34-15s-19e. T.D. 8,745 ft.; 9⅝-in. csg. 7,636 ft.; drlg. sh. 9,014 ft.
Gulf Oil Corp. No. 3 State P.P., sec. 36 23s-21e. Recvd. 1,000 ft. of oil on 6-min. D.S.T. at 6,749-6,846 ft.; 9⅝-in. csg. 6,832 ft.; drlg. 7,121 ft.; rec. 2,000 ft. P.L.O. on D.S.T. 6,958-70 ft.; T.D. 7,269 ft.; P.B. 6,971 ft.; top salt 7,741 ft.; T.D. 8,728 ft.; salt; using hole for geophysical work.
Wm. Helis No. 2 City of New Orleans sec. 19-23s-23e. 10¾-in. csg. 2,646 ft.; drlg. sdy. sh. 7,010 ft.

Plaquemines Parish

Gulf Oil Corp. No. 3 State (Jackson dist) T.D. 8,144 ft.; rec. 1,500 ft. P.L.O. on D.S.T. 8,127-44 ft.
Humble O. & R. Co. No. 9 Orleans Levee Bd., sec. 12-18s-15e. T.D. 1,200 ft.; abd.

St. Bernard Parish

Southern Sulphur Co. No. 2 State Lake Borgne, sec. 38-14s-15e. 13¾-in. csg. 305 ft.; T.D. 3,461 ft.; 7-in. csg. 3,461 ft.
Texas Co. No. 4 State, sec. 14-10s-9e. Drive piling.

St. Martin Parish

Pan American Ref. Co., sec. 11-13s-9e. Drlg. sh. 888 ft.
Shell Pet. Corp. No. 1 Unit, sec. 11-14s-12e. M.I.
Texas Co. No. 10 St. Martin, sec. 15-8s-7e. Drlg. wtr. sd. 7,951 ft.

St. Mary Parish

Shell Pet. Corp. No. 1 Barbour, sec. 21-15s-12e. Drlg. sh. 2,079 ft.
Texas Co. No. 1 State-Bateman Lake, sec. 21-16s-12e. 7⅝-in. csg. 10,515 ft.; T.D. 11,879 ft.; soft formation; P.B. 11,100 ft.; running short string of csg. to btm.

Terrebonne Parish

Barnsdall Oil Co. No. 1 Dilbert, Stark & Brown Sur., sec. 10-16s-15e. Drlg. sd. and sh. 9,710 ft.

Vernon Parish

Castor Creek Drlg. Co. No. 1 Liano Del Rio, Inc., sec. 34-2n-9w. Abd. loc.

TEXAS

Week Ending November 6

GULF COAST FIELDS

Hastings—Brazoria County

Humble O. & R. Co. No. 2 C. W. Alexander, H.T.&B. Sur. No. 28. T.D. 6,080 ft.; W.O.C.
Humble O. & R. Co. No. 3-D W. F. Beers, Perry & Austin Sur. T.D. 6,070 ft.; run csg.
Humble O. & R. Co. No. 10-B Brown, Perry & Austin Sur. Drk.
Humble O. & R. Co. No. 2 S. A. Giesling, H.T.&B. Sur. No. 29. T.D. 5,520 ft.; W.O.C.
Humble O. & R. Co. No. 2 W. G. McDeed, H.T.&B. Sur. No. 30. T.D. 6,080 ft.; run csg.
Humble O. & R. Co. No. 8 South Texas Grain Co., Perry & Austin Sur. T.D. 6,100 ft.; I.P. 610 B.P.D.
Pearland Oil Co. No. 2 C. H. Alexander, H.T.&B. Sur. No. 28. T.D. 6,099 ft.; perf. csg. 6,056-87 ft.; I.P. 617 B.P.D., ¼-in. ck.
Pearland Oil Co. No. 1 J. E. Latimer, H.T.&B. Sur. No. 27. R.U.
Producers Inv. Co. No. 2 Alexander, H. T.&B. Sur. 28. T.D. 6,080 ft.; comp.; no ga.
Stanolind O. & G. Co. No. 17-B W. R. Curkett, H.T.&B. Sur. No. 30. Drlg. sd. 2,354 ft.
Stanolind O. & G. Co. No. 2 C. B. Roberts, R. A. Magee Sur. R.U.
Stanolind O. & G. Co. No. 3 C. B. Roberts, R. A. Magee Sur. R.U.
Stanolind O. & G. Co. No. 6 J. W. Surface, A.C.H.&B. Sur. No. 2. Drlg. sh. 1,234 ft.
Stanolind O. & G. Co. No. 6 W. B. Wooster, A.C.H.&B. Sur. No. 1. R.U.
Stanolind O. & G. Co. No. 6 Autrey, H.T. &B. Sur. No. 37. Core sd. and sh. 6, 150 ft.
Stanolind O. & G. Co. No. 4 Droegmeyer, H.T.&B. Sur. No. 36. Drlg. sh. 5,833 ft.
Stanolind O. & G. Co. No. 6 T. C. Edwards, Wm. Henry Sur. T.D. 6,076 ft.; perf. csg. 6,076-49 ft.
Stanolind No. 6 Brown, H.T.&B. Sur. No. 29. R.U.
Stanolind O. & G. Co. No. 3-B W. H. Avitts, H.T.&B. Sur. Drk.
Stanolind O. & G. Co. No. 2 Matushita, H. Stevens Sur. 10¾-in. csg. 1,227 ft.; T.D. 6,020 ft.; perf. csg. 5,958-6,016 ft.
Stanolind O. & G. Co. No. 4-C Moore, R. A. Magee Sur. T.D. 6,080 ft.; run csg.
Stanolind O. & G. Co. No. 5-C Moore, R. A Magee Sur. Drlg. sh. 6,012 ft.
Stanolind O. & G. Co. No. 1 Peck, H.T.& B. Sur. No. 37. T.D. 6,092 ft.; 7-in. csg. 6,089 ft.; fsg.
Stanolind O. & G. Co. No. 1 Remley, H. T.&B. Sur. No. 28. T.D. 6,080 ft.; perf. csg. 6,036-76 ft.; I.P. 616 B.P.D.; ¼-in. ck.
Stanolind O. & G. Co. No. 2 Sparks, H.T. &B. Sur. No. 29. T.D. 5,670 ft.
Stanolind O. & G. Co. No. 17 Turner, A. C.H.&B. Sur. No. 1. T.D. 6,080 ft.; 7-in. csg. 6,079 ft.; perf. csg. 6,047-76 ft.; I.P. 544 B.P.D., ¼-in. ck.

Lockridge—Brazoria County

Gulf Oil Corp. No. 4 Carrie Baker, J. W. Hall Sur. 10¾-in. csg. 1,332 ft.; T.D. 6,359 ft.; reaming.
Gulf Oil Corp. No. 1 Great Southern, E. D. Robertson Sur. 9⅝-in. csg. 7,145 ft.; core sh. 8,843 ft.
Kirby Pet. Co. No. 2 Carrie Baker, J. W. Hall Sur. 10¾-in. csg. 1,400 ft.; T.D. 6,367 ft.; drlg. plug; P.B. 2,769 ft.; W. O.C.
McCurdy and Johnson No. 1 State, Brazos River. Perf. csg. 6,354-57 ft.; flowed 102 B.P.D., 11/64-in. ck.
Shell Pet. Corp. No. 5-A Ramsey, J. W. Hall Sur. Drk.
Shell Pet. Corp. No. 2-B Ramsey, J. W. Hall Sur. T.D. 6,361 ft.; 7-in. csg. 6,361 ft.
Shell Pet. Corp. No. 4 Ramsey, J. W Hall Sur. T.D. 6,373 ft.; pulling tubing.

Manvel—Brazoria County

Texas Co. No. 31 Houston Oil Field Assn., A.C.H.&B. Sur. R.U.
Texas Co. No. 5 C. L. Lemmer, T. Sprags Sur. Drlg. sh.&sd. 4,029 ft.

Old Ocean—Brazoria County

Harrison & Abercrombie No. 2 Armstrong, Polly & Chance Sur. Drlg. sh. 2,837 ft.
Harrison & Abercrombie No. 1 Copeland-Osborne, C. Breen Sur. Drlg. sh. 9,437 ft.
Harrison & Abercrombie No. 1 Smith, C. Breen Sur. 9⅝-in. csg. 7,016 ft.; T.D. 10,638 ft.; dropped csg. in hole; cmt. 5-in. inside 7-in. at 10,630 ft.

Pledger—Brazoria County

Humble O. & R. Co. No. 1 Norton, Gray & Moore Sur. T.D. 6,790 ft.; 5½-in. csg. 6,530 ft.; comp. for gas well; no ga.

Sandy Point—Brazoria County

H. J. DeArman No. 1 Edmundson, D. Talley Sur. T.D. 6,606 ft.; 5½-in. csg. 6,520 ft.; P.B. 6,500 ft.; perf. csg.
H. J. DeArman No. 3 Fite, D. Talley Sur. T.D. 6,520 ft.; P.B. 6,498 ft.; perf. csg. 6,483-96 ft.; tstg.
Stanolind O. & G. Co. No. 2 Fite, D. Talley Sur. 9⅝-in. csg. 995 ft.; T.D. 6,498 ft.; 5¾-in. csg. 6,492 ft.

West Columbia—Brazoria County

Texas Co. No. 5 Phillips, George Tennille Sur. Drlg. sh. 2,255 ft.
Texas Co. No. 17 Abrams, Geo. Tennille Sur. Drlg. sd. 5,490 ft.
Texas Co. No. 18 Abrams, George Tennille Sur. R.U.
Texas Co. No. 88 Hogg, George Tennille Sur. Drlg. sd. and L. 2,189 ft.
Texas Co.-Sterling O. & R. Co. No. 4 Phillips, Geo. Tennille Sur. 10-in. csg. 1,195 ft.; drlg. sh. and L. 5,038 ft.
Texas Co. No. 2 T. L. Smith, Geo. Tennile Sur. Drlg. sh. 5,200 ft.

Calhoun—Heyser—Victoria County

Blanco Oil Co.-Buchanan No. 2 Dunn-Woody, A. Sisneros Sur. T.D. 5,607 ft.; 7-in. csg. 5,602 ft.; perf. csg. 5,594-5,600 ft.; flowed oil; killed; pulling screen to make squeeze job.
Blanco Oil Co.-Buchannan No. 3 C. S. Dunnwoody, A. Sisneros Sur. Drlg. sh. 2,960 ft.
Geo. Echols No. 1 W. H. Bennett, J. Galban Sur. 10¾-in. csg. 915 ft.; T.D. 5,763 ft.; 7-in. csg. 5,654 ft.; I.P. 5½ B.P.H., 7/64-in. ck.
Geo. H. Echols No. 6 W. H. Bennett, J. E. Galban Sur. Core sh. 5,582 ft.
Gulf Oil Corp. No. 1 Bonner, J. E. Galban Sur. Spd. 100 ft.
Gulf Oil Corp. No. 1 T. P. Traylor, J. E. Galban Sur. 7-in. csg. 5,580 ft.; T.D. 5,750 ft.; tstd. S.W.; cutting and pulling screen.
Humble O. & R. Co. No. 19-B P. H. Welder, A. Sisneros Sur. Drlg. sdy. sh. 3,393 ft.
Humble O. & R. Co. No. 4 H. T. Marshall, T.D. 5,484 ft.; perf. csg. 5,455-84 ft.; tstd. 1,000 ft. of oil; making squeeze job.
Humble O. & R. Co.-Plymouth Oil Co. No. 5 Marshall, A. Sisneros Sur. R.U.
Humble Oil-Plymouth Oil Co. No. 17-B Welder, A. Sisneros Sur. T.D. 5,490 ft.; 5-in. csg. 5,480 ft.; I.P. 13 B.P.H., 3/16-in. choke.
Humble O. & R. Co. No. 18-B P. H. Welder, A. Sisneros Sur. R.U.
Magnolia Pet. Co. No. 3 O. M. Lander, J. E. Galban Sur. Loc.
Magnolia Pet. Co. No. 4 Lander, J. Galban Sur. Core 6,240 ft.
Normandie Oil Co. No. 8 J. G. Cook, A. Sisneros Sur. R.U.
Normandie Oil Co. No. 9 Cook, A. Sisneros Sur. Drlg. sh. 4,679 ft.
Portilla Drlg. Co. No. 11 C. P. H. Welder, A. Sisneros Sur. R.U.
Portilla Drlg. Co. No. 10-C P. H. Welder, A. Sisneros Sur. T.D. 1,048 ft.; T.D. 5,485 ft.; 7-in. csg. 5,485 ft.; perf. csg. 5,478-82 ft.; I.P. 62 bbls. 12 hrs., ⅛-in. ck.
Sun Oil Co. No. 3 W. N. Coffey, J. Galban Sur. T.D. 5,740 ft.; 7-in. csg. 5,740 ft.; I.P. 55 bbls. 10 hrs.; 5/32-in. ck.; T.P. 770 lbs.; C.P. 875 lbs.
Sinclair Prairie Oil Co. No. 2 W. G. Bennett, A. Sisneros Sur. Spd.

Anahuac—Chambers County

Humble O. & R. Co. No. 5 Boyt, sec. 44, H.&T.C. Sur. T.D. 7,149 ft.
Humble O. & R. Co. No. 31 Middleton, sec. 58, H.&T.C. Sur. Drlg. sh. 1,512 ft.
Humble O. & R. Co. No. 16 G. C. Johnson, sec. 57, H.&T.C. Sur. Drk.

Cotton Lake—Chambers County

Humble O. & R. Co. No. 1 Casey, S. Barrow Sur. T.D. 6,520 ft.; 5½-in. csg. 6,509 ft.; I.P. 147 B.P.D., ⅛-in. ck.
Humble O. & R. Co. No. 2 Howard, B. Winfree Sur. Drlg. 70 ft.
Texas Crusader Oil Co. No. 9 Kilgore, J. Townsend Sur. T.D. 6,290 ft.; 7-in. csg. 6,282 ft.; flwd. oil and S.W.; perf. 6,276-78 ft.; tested S.W.; made squeeze job; W.O.C.

Seabreeze—Chambers County

Sun Oil Co. No. 1 Hoffman, T&N.O. Sur. 131. R.U.
Sun Oil Co. No. 2-A Hebert-Broussard, T.&N.O. Sur. 127. R.U.

Turtle Bay—Chambers County

Stanolind O. & G. Co. No. 4 Cooper, S. Burney Sur. Drlg. sh. and sd. 4,600 ft.
Stanolind O. & G. Co. No. 5 Silva, S. Burney Sur. Drlg. sh. 4,328 ft.
Sun Oil Co. No. 7 Chambers, S. Burney Sur. Drlg. sh. 1,310 ft.

Orchard—Fort Bend County

Gulf Oil Corp. No. 53 Moore, J. Frazier Sur. Drlg. sh. 9,898 ft.
Gulf Oil Corp. No. 55 J. M. Moore, J. Frazier Sur. Drlg. sh. 3,466 ft.

Dickinson—Galveston County

Atlantic Ref. Co. No. 3 Lippman, W. G. Banks Sur. Drlg. sh. 6,190 ft.
Frank Bennett No. 3 Way, P. G. Merritt Sur. Drlg. sh. 2,405 ft.
Coast Pet. Co. No. 8 Stewart, W. K. Wilson Sur. Drk.
J. K. Hughes Oil Co. No. 1 J. C. Ecret, W. K. Wilson Sur. Drlg. sh. 6,510 ft.
Humble O. & R. Co. No. 1 M. H. Kreisle, W. K. Wilson Sur. Drk.
Humble O. & R. Co. No. 5-A Stewart, W. K. Wilson Sur. T.D. 8,980 ft.; 7-in. 8,919 ft.; tstg.
Pure Oil Co. No. 2-A Sealy Hutchins, P. G. Merritt Sur. Drlg. sh. 7,341 ft.
Pure Oil Co. No. 1 Sam Levine, W. G. Banks Sur. Drlg. sh. 8,106 ft.
Stanolind O. & G. Co. No. 4 Damiani, W. K. Wilson Sur. 16-in. csg. 300 ft.; drlg. sh. 6,367 ft.
Humble O. & R. Co. No. 1 Wm. Rhoman, J. Sellers Sur. R.U.

High Island—Galveston County

Stanolind O. & G. Co. No. 10 B.&O., M. Dunman Sur. 10¾-in. csg. 1,315 ft.; T.D. 6,658 ft.; 7-in. csg. 6,653 ft.; swbg.
Stanolind O. & G. Co. No. 63 Cade, M. Dunman Sur. 10¾-in. csg. 1,311 ft.; core sd. 6,484 ft.

Hitchcock—Galveston County

N. W. Hunter No. 1 Maco Stewart, J. Spillman Sur. R.U.

Silsbee—Hardin County

Republic Prod. Co.-Houston Oil Co. No. 24 Brooks, G. W. Brooks Sur. T.D. 6,321 ft.; cutting and pulling drill stem.
Republic Prod. Co.-Houston Oil Co. No. 25 Brooks, G. W. Brooks Sur. Drlg. sh. 6,439 ft.

Fairbanks—Harris County

Amerada-Stanolind O. & G. Co. No. 3 Carpenter, F. Fry Sur. T.D. 6,834 ft.; perf. 6,813-20 ft.; flowed 254 bbls. fluid 10 hrs., 6% S.W.
Amerada-Stanolind O. & G. Co. No. 1-B Dopslauf, W.C.R.R. Sur. No. 2, Blk. 1. Drk.

Clinton—Harris County

Stanolind O. & G. Co. No. 1 M. E. Oates. Reels & Trobough Sur. Drlg. sd. and L. 2,189 ft.

Friendswood—Harris County

Circle Oil Co. No. 1 E. B. Ross, George Dedrick Sur. Drlg. sh. 5,512 ft.
H. C. Cockburn No. 1 Barnes. Drlg. sh. 5,912 ft.
Humble O. & R. Co. No. 1 G. M. DeGeorge and Green, T. Choate Sur. T.D. 6,080 ft.; run. Schlumberger.
Humble O. & R. Co. No. 1 Hicks-Hoidale, Perry and Austin Sur. Drk.
Humble O. & R. Co. No. 1 Jones & May, Perry and Austin Sur. Drk.
Humble O. & R. Co. No. 1 Kiesling, T. Choate Sur. R.U.
National Standard Oil Co. No. 1 Coward, Perry & Austin Sur. Loc.

Mykawa—Harris County

H. C. Cockburn No. 2 Minnetex. Wm. Lovett Sur. T.D. 4,923 ft.; 5-in. 4,903 ft.; perf. csg.; tstg.

South Houston—Harris County

Stanolind O. & G. Co. No. 1 Dist. 18. H. T.&B. Sur. No. 5. T.D. 4,800 ft.; S.D.

Tomball—Harris County

Humble O. & R. Co. No. 1 Osborne, R. Hubbard Sur. T.D. 5,576 ft.; W.O.C.
Humble O. & R. Co. No. 2 Rudel, J. Pruitt Sur. T.D. 5,567 ft.; I.P. 311 bbls. 24 hrs., ¼-in. ck.
Humble O. & R. Co. No. 1-B W. B. Sherrer, J. House Sur. T.D. 5,570 ft.; 5½-in. csg. 5,568 ft.; I.P. 24 B.P.H.; ¼-in. ck.
Humble O. & R. Co. No. 1 John Weathersby, J. Pruitt Sur. Drlg. sh. 945 ft.
Humble O. & R. Co. No. 2 N. W. Stehly, J. Pruitt Sur. T.D. 5,587 ft.; 5½-in. csg. 5,587 ft.; I.P. 508 B.P.D., ¼-in. ck.
Shell Pet. Corp. No. 1 Stokely, J. S. Smith Sur. Drlg. sh. 5,583 ft.

Ganado—Jackson County

Texas Co. No. 1 Mortg. Ld. & Inv. Co., Morris & Cummins Sur. No. 3. T.D. 5,100 ft.; 7-in. csg. 5,085 ft.; perf. csg. 5,080-82 ft.; make squeeze job.

Amelia—Jefferson County

Humble O. & R. Co. No. 10 Crook, C. Williams Sur. Drlg. sh. 2,312 ft.
Humble O. & R. Co. No. 1 S. L. Guinn, C. Williams Sur. R.U.
Humble O. & R. Co. No. 12 Guinn, C. Williams Sur. Drk.
Humble O. & R. Co. No. 12 Phelan, C. Williams Sur. Drk.
Humble O. & R. Co. No. 2-C Pinchback, C. Williams Sur. R.U.
Humble O. & R. No. 2-D Pinchback, C. Williams Sur. Loc.
Glenn H. McCarthy No. 3-B Longe, H. Williams Sur. T.D. 6,095 ft.; 7-in. csg. 6,091 ft.; squeezed off perf.. W.O.C.
Stanolind O. & G. Co. No. 1 Keith, H. Williams Sur. T.D. 5,400 ft.; 7-in. csg. 5,349 ft.; I.P. 116 B.P.D., ⅜-in. ck.
Stanolind O. & G. Co. No. 7 McCormick, H. Williams Sur. T.D. 5,396 ft.; 7-in. csg. 5,366 ft.; I.P. 355 B.P.D., ¼-in. ck.
Stanolind O. & G. Co. No. 8 McCormick, H. Williams Sur. Drlg. sdy. sh. 5,630 ft.
Sun Oil Co. No. 1 W. D. Gordon, A. Houston Sur. Drlg. sh. 6,019 ft.
Texas Co. No. 2 Pansy Yount, A. Houston Sur. R.U.

Big Hill—Jefferson County

Stanolind O. & G. Co. No. 2 May Fitzhugh, Wm. McFadden Sur. T.D. 4,047 ft.; 10¾-in. csg. 4,040 ft.; drlg. sh. 4,877 ft.
Stanolind O. & G. Co. No. 4-A Pipkin. T.&N.O. Sur. T.D. 5,448 ft.; reaming.

Fannett—Jefferson County

Gulf Oil Corp. No. 1 Junker-Spencer, W. H. Smith Sur. Drlg. sh. 7,069 ft.

LaBelle—Jefferson County

Sun Oil Co. No. 1 John Ward, 933 ft. S of No. 2 Broussard, Wm. Burton Sur. 18⅝-in. csg. 109 ft.; 9⅝-in. csg. 8,538 ft.; 7-in. csg. 9,951 ft.; T.D. 10,147 ft.; cmtd. off bttm.; perf. csg. 8,545-90 ft.; showed no press.; pulled tbg. to 8,247 ft.; swbg.

Nome—Jefferson County

Lee Bros. Oil Co. No. 1 F. C. Wilson, C. L. Nash Sur. Drlg. sh. 150 ft.
Shell Pet. Corp. No. 4-A Texas Public Service Co., W. H. Aldridge Sur. R.U. as relief well; drlg. sh. 4,682 ft.
Sun No. 8 Long, J. Blair Sur. T.D. 6,040 ft.; 7-in. csg. 6,001 ft.; perf. csg. 5,666-57 ft.
Sun Oil Co. No. 2 Tindall, A. Horton Sur. 7-in. csg. 5,645 ft.; T.D. 6,070 ft.; P.B. 5,680 ft.; make D.S.T.

Cleveland—Liberty County

Gulf Oil Corp. No. 2-C Kirby Lbr. Co., J. Pleasants Sur. T.D. 5,825 ft.; make D.S.T.

Hardin—Liberty County

Jack Frazier No. 2 Lynott & Buffam, J. Robson Sur. R.U.

Jack Frazier No. 1 Buffam-Benning, J. Robeson Sur. R.U.
J. W. Frazier No. 1-B Lynott and Buffman, J. Robeson Sur. T.D. 7,696 ft.; S.W.; abd.
Gulf Oil Corp. No. 1 V. B. Hinson, H. B. Johnston Sur. R.U.
Jameson-Bryon No. 1 W. B. Hinson, H. B. Johnson Sur. R.U.
Shell Pet. Corp. No. 1 Hanchey, H. B. Johnson Sur. Drlg. sh. 6,716 ft.
Strake Pet. Corp. No. 3 Finley, A. B. Hardin Sur. R.U.
Strake Pet. Corp. No. 2 W. T. Finley, A. B. Hardin Sur. Drlg. sh. 1,500 ft.

Hull—Liberty County

Woodley Pet. Co. No. 4 McMurtry Sur. Loc.
Hamill-Smith No. 3 Barrow, J. Devore Sur. 10-in. csg. 960 ft.; drlg. sh. 1,810 ft.
Texas Co. No. 10 Hannah, J. Devore Sur. T.D. 5,573 ft.; run 7-in. csg.

South Call—Newton County

Houston Oil Co. No. 2 Sabinetram. R.U.
Houston Oil Co.-Republic Prod. Co. No. 2 Peavy-Moore Lbr. Co., sec. 42, H.&T.C Sur. 16-in. pipe 58 ft.; T.D. 7,372 ft.; abd.

Bay City—Matagorda County

Hamman Expl. Co. No. 1 Sloan, J. T. Belknap Sur. R.U.
Hamman Expl. Co. No. 1 H. E. Thompson, Hall Sur. T.D. 9,184 ft.; 7-in. csg. 9,184 ft.; perf. csg.; I.P. 212 B.P.D., ¾-in. ck.
Smith and McDannald No. 1 Gaines, E. Hall Sur. Spd.

Buckeye—Matagorda County

United North & South Development Co No. 1 G.B.M., Cotton Lge. 7-in. csg. 8,667 ft.; drlg. sh. 9,721 ft.

Markham—Matagorda County

Harrison & Abercrombie No. 1-B Kountze, H. Parker Sur. T.D. 4,286 ft.; heaving sh.; P.B. 1,881 ft.

Palacios—Matagorda County

Atlantic-McCarthy No. 3 Foley Ld. Co., L. Goodwin Sur. Drk.
Atlantic-McCarthy No. 2 Palacios State Bank L. Goodwin Sur. T.D. 8,576 ft.; abd.
Glenn McCarthy No. 2 Foley, L. Goodwin Sur. T.D. 8,590 ft.; sdtrk.; drilled to 8,540 ft.; rmg.
Sun Oil Co. No. 1 Bay Shore Farms, Lewis Goodwin Sur. Drlg. sh. 11,111 ft.

Van Vleck—Matagorda County

Skelly Oil Co. No. 14-B Cobb, M. Cummins Sur. 0⅝-in. csg. 8,478 ft.; core sh. 8,765 ft.

Orange—Orange County

Tillery & Ryan No. 1 Chesson, Wm. Dyson Sur. 10¾-in. csg. 1,180 ft.; T.D. 5,946 ft.; 7-in. csg. 5,930 ft.; rec. 1,500 ft. of P.L.O. on drill stem test.

Port Neches—Orange County

Texas Co. No. 6 W. H. Starks, W. E. Hall Sur. Drlg. sh. 2,447 ft.

Livingston—Polk County

Gem Oil Co. No. 5 Kavanaugh, A. Viesca Sur. 10¾-in. csg. 907 ft.; T.D. 4,218 ft.; reaming to make D.S.T.

Segno—Polk County

Gulf Oil Corp. No. 8 Wing, sec. 14, I.&G N. Sur. T.D. 6,765 ft.; 5-in. csg. 6,630 ft.; P.B. 6,627 ft., perf. csg. 6,261-6,264 ft.; flowed 531 bbls. fluid, 50% oil and S.W.; squeeze off perf.

Spurger—Tyler County

Republic Prod. Co. No. 6 Hurd, N. Hurd Sur. Drk.
Republic-Houston Oil Co. No. 5 Hurd fee N. Hurd Lge. T.D. 8,180 ft.; 7-in. csg. 7,759 ft.

Keeran—Victoria County

Gulf Oil Corp. No. 12 G. R. Keeran Est. T.D. 5,590 ft.; 7-in. csg. 5,500 ft.; I.P. 344 B.P.D., ¼-in. ck.
Union Oil Co. No. 7 Keeran, M. DeLeon Sur. T.D. 6,016 ft.; abd.

*** McFaddin—Victoria County**

Barnsdall Oil Co. No. 1 J. A. McFaddin Est., Foster Lewers Sur. R.U.

Placedo—Victoria County

H. B. Ownby Drilling Co. No. 2 Henderson and Pickering, S.A.&M.G. Sur. Spd.

Tellener—Victoria County

Gulf Oil Corp. No. 1 Mahon and Buhler, W. C. Carroll Sur. T.D. 6,167 ft.; P.B. and sdtrkd; drlg. sh. 6,865 ft.
Union Oil Co. No. 8 Keeran Est., M. DeLeon Sur. R.U.

Clay Creek—Washington County

Sun Oil Co. No. 7 Droeger, J. F. Perry Sur. T.D. 4,410 ft.; fsg.

Five Corners—Wharton County

Texas Co. No. 11-B Pierce Est., A. H. Pierce Sur. R.U.

Magnet—Wharton County

Atlantic Refining Co. No. 7-B H. C. Cockburn, Smith and McKenzie Sur. R.U.
Atlantic Ref. Co. No. 6-B Cockburn, Smith & McKenzie Sur. T.D. 5,540 ft.; 7-in. csg. 5,537 ft.; perf. csg. 5,524-30 ft.; made squeeze job; testing; would not flow; pull screen and liner.
Humble O. & R. Co. No. 4 Cockburn, S. Castleman Sur. R.U.
Humble O. & R. Co. No. 3 Cockburn, Smith & McKenzie Sur. T.D. 5,540 ft.; 5½-in. csg. 5,535 ft.
Texas Crusader Oil Co. No. 3 Cockburn, Smith & McKenzie Sur. T.D. 5,540 ft.; 7-in. csg. 5,534 ft.

Pickett Ridge—Wharton County

Gilcrease Oil Co. No. 1 W. W. Duson, Gifford Sur. T.D. 4,708 ft.; perf. csg. 4,689-93 ft.; I.P. 120 B.P.D., 10/64-in. ck.
Texas Crusader Oil Co. No. 3 J. F. Kubella, G. C. Gifford Sur. Drlg. 700 ft.

Withers—Wharton County

Texas Co. No. 32-C Pierce Est., Wm. Pettus Sur. Drlg. sh. and L. 4,500 ft.
Texas Co. No. 39-C Pierce, J. Caldwell Sur. 16-in. csg. 33 ft.; T.D. 5,558 ft.; P.B. 5,539 ft.; comp. for gas well.
Texas Co. No. 3 Thompson, J. Caldwell Sur. T.D. 5,552 ft.. 7-in. csg. 5,543 ft.

GULF COAST WILDCATS

Brazoria County

Pure Oil Co. No. 1 W. A. Smith, S. F. Austin Sur. 18⅝-in. csg. 139 ft.; drlg. sh. 3,650 ft.

Colorado County

O. C. Garvey No. 1 Buback-Ernest, M. Lapham Sur. R.U.

Chambers County

Merit Oil Co. No. 1 T. and M. Wright, C Smith Sur. 10¾-in. csg. 1,302 ft.; T.D. 7,515 ft.; 7-in. csg. 6,602 ft.; perf. 6,424-39 ft.; tstd. 25 ft. of oil, 800 ft. S.W.

Fort Bend County

Chapman Minerals Corp. No. 1 Sugarland, Geo. Brown & Belknap Sur. Drlg. 1,612 ft.

Galveston County

R. R. Gray et al No. 1 Eidman, Anthony Hatch Sur. R.U.

Hardin County

Humble O. & R. Co. No. 1-A Olive Stermberg, J. Taylor Sur. Abd. 6,500 ft.
John Mayo No. 1 Hayden, W. K. Griffin Sur. M.I.

Harris County

H. C. Cockburn No. 1 White, Harris & Carpenter Sur. Spd.

Jackson County

Cockburn et al No. 1 Hodges, I.&G.N. Sur. No. 7. Spd.
Cockburn & Hargrove No. 1 Mike Strauss, A. M. Clare Sur. 10¾-in. csg. 779 ft.; T.D. 5,424 ft.; wtr. sd.
Sam G. Harrison et al No. 1 H. A. Meyers, O. York Sur. R.U.
Magnolia Pet. Co. No. 1-A West ranch, R. Musgquez Sur. R.U.

Jefferson County

Shell Pet. Corp. No. 1 W. P. McFaddin, S. A. Pace Sur. No. 2. Bldg. road.

Liberty County

Humble O. & R. Co. No. 1 E. J. Moore, M. Whittington Sur. Drk.
Humble O. & R. Co. No. 2 Sabine Tram, Malinda Whittington Sur. (Devers area). T.D. 9,515 ft.; abd.

Madison County

Faucett & Kyle No. 1 Bailey, T. Boatwright Sur. 10-in. csg. 39 ft.; T.D. 600 ft.; S.D.
Faucett & Kyle No. 1 Connor, J. P. Phillips Sur. S.D. 1,663 ft.; cmtd. csg. to tst.
W. H. Lawrence No. 1 Gustavis, J. Woodruff Sur. Drlg. sh. 1,213 ft.

Matagorda County

Sun Oil Co. No. 1 Fred Robbins, C. H. Vandeveer Sur. Drlg. sh. and L. 3,078 ft.

Orange County

Glenn H. McCarthy No. 1 Brown, B. Garner Sur. M.I.R.

Polk County

Stewart Oil Co. No. 1 E. J. Galloway, J. Ringgold Sur. 10¾-in. csg. 1,000 ft.

Refugio County

Hogan Oil Co. No. 1 Kelley, M. & A. Roache Sur. Drlg. sh. 5,350 ft.

Trinity County

Gossage-Green and Thompson No. 1 R. E Thompson, J. A. Hickey Sur. Drk.

Victoria County

W. V. Bowles No. 1 Robertson, T.G. Burnham Sur. Drlg. sh. 3,610 ft.
Stanolind O. & G. Co. No. 1 Henderson & Pickering, E. Benavides Sur. T.D. 7,468 ft.; fsg.

Waller County

J. Brian Eby et al No. 1 Wm. Rice Institute, H. Stephens Sur. Drlg. sh. 2,519 ft.
Humble O. & R. Co. No. 1-A South Tex. Dev. Co., Wm. Hillhouse Sur. Drk.
Stanolind O. & G. Co. No. 1 Security Tr., H.&T.C. Sur. No. 99. T.D. 2,506 ft.; run surf. csg.

Washington County

K. D. Harrison and C. E. Starr No. 1 Charles and Wm. Ellerman. Wm. Bridges Lge. 13-in. csg. 290 ft.; abd.

Walker County

G. C. Dixon No. 1 Morgan, J. Ford Sur. Drk.
W. B. Gossage et al No. 1 Carey Ld. & Dev. Co., D. McDonald Sur. S.D. 2,220 ft.

S. W. TEXAS WILDCATS

Atascosa County

L. W. Steiren No. 1 Crawford, 4 mi. W of Anchorage. Sd. 2,480-90 ft.; S.O.; T. Serp. 3,348 ft.; cg. 3,353 ft.

Bastrop County

J. W. Bibb No. 1 Lentz, F. Wilkenson Sur. S.D. 1,350 ft.
Hantho-Nelson, Inc., No. 2 Litton, Cedar Creek Community. Drlg 310 ft.
Sunrise Oil Co. No. 1 Smith, E. Standifer Sur. O.W.W.O.; old T.D. 2,502 ft.: prep. P.B. 1,712 ft.

Bell County

W. H. Vernor No. 1 McQueen, 9 mi. S of Belton. S.D. 2,160 ft.

Caldwell County

Fain Gillock No. 1 Kelly, Berry Sur. T.D. 1,692 ft.; S.O.; setting csg.
Heard & Heard No. 1 Brown, McCarley Sur. S.D. 2,300 ft.
Fred Shields No. 1 Miears, Swearingen Sur. D.&A.; T.D. 2,294 ft.

Comal County

L. H. Wilson No. 1 Alexander, D. Benton Sur. Skdg. on.
J. R. Yates No. 2 Heidrich, Heidrich ranch. D.&A.; T.D. (cor.) 1,867 ft.

DeWitt County

Ike Howeth No. 1 Gips, Moore Sur. R.U.
Whitex Oil Co. No. 1 Kerlick, Sewell Sur. D.&A. 4,453 ft.

Dimmit County

Texs & Maryland Corp. No. 1 McKnight, Blk. 13, sec. 23. Drlg. sh. 3,565 ft.

Duval County

T. R. Andrews No. 1 Hazelwood, Hopkins Sur. R.U.
Magnolia Pet. Co. No. 1 D.C.R.C., Sur. 261. Drlg. 2,357 ft.
Magnolia Pet. Co. No. 1 Ruiz, Sur. 190. Drlg. 5,207 ft.
Penn-Palangana Oil Co. No. 2 Schallert, Sur. 239. S.D.; T.D. (cor.) 365 ft.

Edwards County

Amon G. Carter No. 1 Sweeten, SE¼, Blk. 2, Sur. 49. Fsg.; T.D. (cor.) 5,090 ft.
C. V. Lyman No. 1 Brown, Blk. 3. R.U.

Frio County

Pagenkopf & Jamieson No. 1 Houston Est., 2,254-ac. tr., J. Figuerroa Sur. S.O. 2,610-03 ft.; set csg. to test 7-in. at 2,480 ft.; swbg.; S.O.&G. and wash wtr.; T.D. 2,651 ft.; set csg.; P.B. 2,607 ft.; pumping oil and acid.

Goliad County

Goliad Oil Corp. No. 1-A Cole, Lot 33, Goliad town tr. T.D. 5,687 ft.; wash. to bottom.
Rual Swiger No. 1-B Wood, J. Shearn Sur. Drlg. sh. 1,607 ft.

Gonzales County

E. A. Redding et al No. 1 Bozka, D.&A., 3,207 ft.

Guadalupe County

Ellmag Oil Co. No. 1 Hardiman, Dikes Sur. T.D. 2,201½ ft.; rng. csg.
Mehu Oil Corp. No. 1 Schulze, Chenault Sur. Drlg. ch. 1,456 ft.
Olsen Oil Co. No. 1 Lillard, John Tom Sur. D.&A. 2,057 ft.
Wellington Oil Co. No. 1 Koepp, W. H. Smith Sur. Drlg. 252 ft.

Hidalgo County

Atlantic Ref. Co. No. 1 American Rio Grande. Gas sd. 8,025-60 ft.; blew out; killed and csg. ahead.
Y. & B. Oil Co. No. 1 Waite, Tr. 382, Los Jidos Gr. Drlg. (cor.) 5,265 ft.

Jim Wells County

H. M. Hill et al No. 1 Kuether, Lots 70 and 75, sec. 52, Haldeman Subd. Spdd.; W.O.C.
Howell et al No. 1 Talbot, 181-ac. tr., Lavaca Gr. Drlg. 5,507 ft.
Magnolia Pet. Co. No. 7 Seeligson, 10.433-ac. tr., Los Jaboncillos Gr. Cg. 8,142 ft.

Karnes County

Ivan Howard No. 1 Moczygemba, Erasmo Seguin 5, League Gr. Top sd. S.O. 2,159 ft.; oil sd. 2,174-78 ft.; Rng. csg. 2,136 ft.

Kendall County

Landon & Peffley No. 1 Seidensticker. Sur. 257, Chorcon Gr. D.&A. 530 ft.

Kenedy County

La Sal Vieja Oil Corp. No. 1 Garcia Ld. & Cattle Co., Blk. 95, Tr. 73. Drlg. 4,247 ft.

LaSalle County

Ralph B. Reed No. 1 Yeager, Blk. 7, Sec. 8, Wallace Subd. Yeager ranch. M.I.M.

Lee County

Jas. E. Pederson No. 1 Turner, David Hudson Sur. S.O.&G. 6,140-80 ft.; sdtrkd. at 4,600 ft. and drld. to 6,132 ft.; S.O.&G.; set csg. 6,021 ft.; acdzg. with 20-bbl. load; when opened well flwd. 20-bbl. head and went dead; swbd. oil and wtr.; acd.; to put on pmp.; S.D.

Live Oak County

Chiquita Oil Co. No. 1-A Taylor-Lark, Scrugham Sur. Set csg. 972 ft.; W.O.C.
L. Franklin No. 1 Odem, R. Everitt Sur. Set surf. csg.; W.O.C.
Holland Oil Co. No. 1 Alamo Lbr. Co., Lot 26, Blk. 16, Sur. 99. M.I.M.
Reynosa Oil Co. No. 1-A Nichols, 100-ac. tr., Sudb. "B," Simeon Ryan Sur. Spd.
V. G. Schimmel No. 1 West, sec. 59, Haas Sur. R.U.

Maverick County

Wellington Oil Co. No. 1 Chittam, 330 ft. N line, 2,310 ft. W line, sec. 129, Blk. 7. T.D. 3,287 ft.; flwd. intemittently at rate of 10 B.P.H. and went dead; acidized.; swbd. 7 B.P.H.; T.D. 3,287 ft.; acdzd.; C.O.

McMullen County

Adams & LeFevre No. 2 Selman, sec. 58. R.U.
Alabama Minerals Oil Co. No. 2 Gordon, Sur. 127. Drlg. 497 ft.
Coyle & Bedwell No. 1 Two Rivers Rnch. Co., sec. 60. S.D. 10 ft.
V. G. Schimmel No. 1 Kountz, E.T.&R.R. Sur. D.&A. 2,370 ft.

Medina County

Adams et al No. 1 Kreisle, Sur. 908. R.U.
R. S. Boiling No. 1 McMenemy, Sur. 33¼. R.U.
M. L. Walker No. 1 Riff, Hans Sur. No. 43. Drlg. sh. 311 ft.

Milam County

Kingdor Expln. Co. No. 1 Stidham. S.D. 3,818 ft.

Nueces County

Culton & Meador No. 1 Bailey Est., Blk. 65, J. Elliff Subd., Joaquin Lopez de Herrera Sur. T.D. 4,205 ft.; reaming rathole.
Mills Bennett Prod. Co. No. 1 Johnson, sec. 125, Pauls Subd. Cg. 5,343 ft.
Richardson Pet. Co. No. 1 Cunningham, sec. 77. Drlg. 3,506 ft.
Sannix Oil Co. No. 1 Nesloney, 760-ac. tr., Casa Blanca Gr. Cg. 4,727 ft.
Southern Minerals Corp. No. 2 King, Blk. 6, R. King Farm Lots. D.S.T. 4,020-33 ft.; rec. 640 ft. oil, 850 ft. S.W. in 20 min. at 35 lbs. W.P.; T.D. 6,219 ft.; P.B. to 4,000 ft. sd. to perf.
Union Prod. Co. No. 1 Simmons, 1,000-ac. tr., Agua Dulce Gr. Drlg. sh. 4,856 ft.

San Patricio County

Argo Oil Corp. No. 1 Soehnge, 159.66-ac. tr., Blk. 11, Schleicher & Joseph Subd., Delgado Gr. T.D. 4,962 ft.; top sd. 4,957 ft.; well tried to blow out; killed to deepen. drlg. 6,143 ft.
H. J. Porter No. 1 Schmalsteig, sec. 9, Paul Subd. D.&A. 6,513 ft.
Rutherford O. Corp. No. 1 George, Lot 12, Geo. Paul Subd. M.I.M.
Sioux Oil Co. No. 6 Ricaby, Porc. 83. Drlg. 956 ft.

Starr County

Calderoni-James-Foliette No. 1 Rodrigues Blk. 6, Sh. 56. Porc. 80. Set 4½-in. csg. 1,483 ft.; T.D. 1,511 ft.; P.B. T.D. 1,756 ft.; S.D.; W.O.O.
Collins No. 1 Guerra, Sh. 6, San Jose Gr. Cg. 4,297 ft.
Dodd Tr. No. 1 Wardner, Vela Sur., Porc. 84. Drlg. 1,077 ft.
G. E. Dodd No. 1 Wood Est. Set 10-in. surf. csg. 80 ft.; W.O.C.
Sun Oil Co. No. 1-F Guerra, Salvador Garcia heirs Sur., Porc. 109. Drlg. 1,182 ft.
Transwestern Oil Co. and Davenport No. 3 Slick, sec. 527. T.D. 6,862 ft.; fsg.

Travis County

W. O. Caffey No. 1 Bremond, 104.5-ac. tr., Santiago del Valle Sur. Drlg. 514 ft.
W. O. Caffey No. 1 Meister, Conrad Sur. S.D.
D. E. Hamer No. 1 Benson, Wilson Sur. drlg. L. 404 ft.
LaShell, Gardner & Wilson No. 1 Wilson, Blk. 1. T.D. 650 ft.; S.O.; to core deeper and test.
J. E. Mills No. 1 Washington, Navarro Sur. S.D. 1,150 ft.

Webb County

O. W. Killam No. 1 Garcia, Blk. 26, Los Ojuelos Sur. D.&A. 3,011 ft.
Lemp Oil Co. No. 1 Clark, 500-ac. tr., Porc. 33. Drlg. 230 ft.
Lewis et al No. 1 Garza, Sur. 48. R.U.
Mills Bennett Prod. Co. No. 1 Gates, Blk. 28, Sur. 200. Cg. 1,557 ft.

Willacy County

Magnolia Pet. Co. No. 1 Armendiaz, Sh. 4, San Juan de Carricitos Sur. Drlg sh. 5,747 ft.; cored oil sd. 5,586-5,600 ft.

Wilson County

Arnold, Dink, Stone & Haley No. 1 Black, 1,102.3-ac. tr., hrs. of Juan and Simon Arocha Sur. S.D. 706 ft.
Pat Higgins No. 1 Higgins, Rodrigues Sur. 277. S.D. 1,815 ft.
W. D. Parkinson No. 1 Burney, Arocha Sur. Drlg. sh. 159 ft.

S. W. TEXAS PROVEN

Lamar—Aransas County

Barnsdall Oil Co. No. 1 Kate Edwards, Lot 87, Lamar Townsite. Old T.D. 7,996 ft.; set screen for prod. tst.; S.D.; repair pmp.

McCampbell—Aransas-San Patricio Counties

Atlantic Ref. Co. No. 9-C McCampbell, Lot 2, Blk. 41. Cg. 6,707 ft.
Atlantic Ref. Co. No. 3 Maryland Trust, Blk. 23. T.D. 7,135 ft.; rng. csg.
Atlantic Ref. Co. No. 1-D Murray, Lot 3, Blk. 37. Set surf. csg. 1,500 ft.; W.O.C.
Atlantic Refining Co. No. 2-A Porterfield, Lot 8, Blk. 14. M.I.M.
Atlantic Ref. Co. No. 4-B Porterfield, Blk. 10, Lot 10. T.D. 7,188 ft.; sd. 7,183-98 ft.; washing in.
Atlantic Ref. Co. No. 5-B Porterfield, Blk. 1. T.D. 7,210 ft.; set csg.; W.O.C.
Atlantic Refining Co. No. 6-B Porterfield, Lot 6, Blk. 10, McCampbell Subd. Drlg. 3,817 ft.
Atlantic Ref. Co. No. 1-C Porterfield, Lot 8, Blk. 12. S.D. 8,880 ft.
Atlantic Ref. Co. et al No. 1-D Porterfield,

Lot 10, Blk. 13. Set csg. 7,226 ft.; perf. 7,202-06 ft.; comp.; 379 B.P.D.. ⅛-in. ck.; set 7-in. csg. 7,213 ft.
Atlantic Ref. Co. No. 2-D Porterfield, Blk. 37. Drlg. 5,889 ft.
Buckingham Oil Co. No. 1-B McCampbell, Lots 13 and 14, Blk. 40. O.W.W.O.; old T.D. 6,557 ft.; sdtrkd. 6,351 ft.; T.D. 6,559 ft., perf. 6,538-46 ft.; comp.; 120 B.P.D., 50% S.W., ¼-in. ck.; T.D. 6,559 ft.
Buckingham Oil Co. No. 2-B McCampbell, Lot 13, Blk. 40. O.W.W.O.; old T.D. s.w. S.D. 7,526 ft. R.U.
Franston Oil Co. No. 1 Murray, Lot 7, Blk. 37. Drlg. 7,199 ft.
Graham Oil Co. No. 2 Edwards, Lot 16, Blk. 7. Drlg. sh. 4,435 ft.
Graham & Buckingham Oil Co. No. 3 Porterfield, Blk. 9, Lot 8. O. and G. sd. 6,539-60 ft.; gas sd. 6,757-75 ft.; cg. 6,777 ft.
Landreth Prod. Co. No. 7-A McCampbell, Lot 1, Blk. 39. O.&G. sd. 7,099-7,124 ft.; T.D. 7,125 ft.; set 7-in. csg. 7,125 ft.; perf. 7,117-19 ft.
Norman Bertleson No. 2-A Murray, Lot 5, Blk. 37. Drlg. 6,577 ft.
Shasta Oil Co. No. 1 Davis, Lot 16, Blk. 9. Set csg. 7,130 ft.; perf. 7,104-09 ft.; comp.; 219 B.P.D. on ¼-in. ck.
Guy Warren & Carmos Drlg. Co. No. 1 Kleineck, Lot 12, Blk. 9. Set 7-in. csg. at T.D. 7,160 ft.; perf. 7,125-30 ft.; clg.

Carroll—Bastrop County

Nelson Puett No. 7 Carroll Est., Andrew Mays Sur. Comp. 20 B.P.D. pump.

North Dale—Bastrop County

Marts & Beavens No. 1 Lackey, Gray Sur. T.D. 2,225 ft.. swbg.; set 5½-in. csg. 2,159 ft.

Normanna—Bee County

J. R. Dougherty No. 1 fee, Blk. 11, Patrick Carroll Sur. Drlg. sh. 1,415 ft.

West Tuleta—Bee County

Salt Dome Oil Co. No. 3 Tuleta Merchantile Co., SW¼, sec. 10, Wragley Subd Uranga Gr. Jtg.; T.D. 3,079 ft.; S.D.; W.O.A.

Von Ormy—Bexar County

Ed Auge No. 1 Hernandez, Paschel Sur. 52. Cg. 556 ft.
Roger Putnam No. 9 Wetz, Simpson Sur. R.U.

Alta Mesa—Brooks County

Standard of Texas No. 5 Mestina Lease No. 1. 7-in. csg. set 3,220 ft.; T.D. 5,505 ft.; perf. 4,513-20 ft.; plugged and re perf. 4,520-24 ft.; perf. 4,170-74 ft. and 4,142-76 ft.; tstg.
Standard Oil Co. of Texas No. 10 Mestina, Lse. No. 1, La Mestina & Gonzalina Sur. Prep. D.S.T. 2,596-2,613 ft.

Alta Verde—Brooks County

Bishop & Woods No. 1 Powers, 378-ac. tr., Sur. 311. Drlg. sdy. sh. 1,310 ft.

Branyon—Caldwell County

Compton et al No. 1 Atkinson, J. Pinchback Sur. Drlg. plugs; set 7-in. csg. 2,058 ft.
Four Link Oil Co. No. 5 Magee, Neill Sur. Comp.; 218 B.P.D., ¼-in. ck.; T.D. 2,061 ft.; T.C. 2,002 ft.
Lincoln Pet. Co. No. 6-B Branyon, Miller Sur. T.D. 2,344 ft.; tstg.
Martell Pet. Co. No. 2 Young, J. R. Miller Sur. Drlg. ch. 2,167 ft.
Perot Oil Corp. No. 2 Brown, J. R. Miller Sur. T.C. 1,920 ft.; set 7-in. csg. 1,920 ft.; T.D. 2,150 ft.. pumping; no ga.
Perot Oil Co. No. 3 Brown, Miller Sur. Set csg. 1,923 ft.; W.O.C.; T.D. 2,101 ft.
Second Nation Oil Co. No. 2 White, J. Pinchback Sur. T.D. 2,430 ft.; S.D.; W.O.O.
Taylor Ref. Co. No. 10-A Branyon, Cooper Sur. Set csg. 2,303 ft.; comp.; 63 B. P.D. on pmp.; T.D. 2,332 ft.

Buchanan—Caldwell County

Edwill Oil Co. No. 4 Browne, Chas. M Cannon Sur. Set 7-in. csg. 1,880 ft.; R.U. pump; T.D. 2,287 ft.
G. D. Fairtrace No. 1 McMahon, Pinchback Sur. T.D. L. 2,404 ft.; pump. oil and drlg. mud
McAlester Fuel Oil Co. No. 3 Miears, Cannon Sur. Set surf. csg. 20 ft.; T.D. Edw. 2,512 ft.; pmp.; no ga.; P.B. 2,-250 ft.
Ralph Ogden No. 1 Dinges, Damon Sur. Set 7-in. csg. 1,861 ft.; T.D. 2,205 ft.; rng. tbg.
Lewis-Patton & Co. No. 2 Brown, Cannon Sur. Cg. 2,093 ft.
Potter-Snowden No. 5 Medlin, Cannon Sur. T.D. ck. 2,237 ft.; R.U. pump.
Potter-Snowden No. 6 Medlin, Cannon Sur. Set csg. 51 ft.; Set 7-in. csg.; T.D. 2,220 ft.. S.I.

Burdett Wells—Caldwell County

F. & W. Oil Co. No. 2 Rodenberg, Guadalupe College Sur. Drlg. sh. 1,707 ft.
Lanning & Coffield No. 1 Rodenberg, Guadalupe College Sur. 7-in. csg. 2,208 ft.; T.D. L. 2,212 ft.; W.O.P.

Dale—Caldwell County

Marts & Beavens No. 1 Miears, Swearingen Sur. Drlg. Tay. 1,796 ft.
R. R. Ogden No. 1 Dinges, Swearingen Sur. T.D. Serp. 2,205 ft.; pumping; no ga.
R. Ogden No. 2 Dinges, S. Damon Sur. Cg. 1,895 ft.

Dunlap—Caldwell County

Detroit Texas Oil Co. No. 2 Carter, Highsmith Sur. 13. Drlg. sh. 1,117 ft.
Chas. Schreiner No. 1 Moody, Seal Sur. Drlg. ch. 2,172 ft.

Larremore—Caldwell County

Spokane O. & G. Co. and Okla. O. & G. Co. No. 3 Starkey, C. Crenshaw Sur. T.D. 1,303 ft.; acidizing.

Lytton Springs—Caldwell County

E. R. Cosby No. 1 Crenshaw, J. O. Burleson Sur. Cg. out at 1,200 ft.. T.D. 1,-698 ft.

Salt Flat—Caldwell County

Bruce Albright No. 1 Smith, Hinds Sur. Set csg. 2,658½ ft.; W.O.C.
Louis Crouch No. 1 Davis, Hinds Sur T.D. 2,612 ft.; set 5½-in. csg. 2,298 ft; W.O.P.
E. J. Koeugh No. 1 Tiller, Hinds Sur T.D. 2,475 ft.; flwg. est. 75 B.P.D. by hds. R.U. pump.
Pummel & Brady No. 1 Jackson, S. Morris Sur. S.D. 1,500 ft.
Ellmag Oil Co. No. 1 Pope, J. P. Rains Sur. T.D. 2,731 ft.; acdzd.
Geo. Haines No. 1 Davis, Hinds Sur. Drlg. 178 ft.

Benavides—Duval County

Arkansas Fuel Oil Co. No. 8 Rossi, Flores Gr. No. 25. Ran tbg.; set 7-in. csg. 4,753 ft.
Benedum & Trees Oil Co. No. 8 Puig. 750-ac. tr., San Andres Gr. Oil sd. 4,-794-4,800 ft.; set csg. 4,794 ft.; T.D. 4,-802 ft.; flwd. 44 B.P.D. on ¼-in. ck.; went dead; plg. tbg.
Blanchard No. 1 Puig, Blk. 59, Sur. 238. O.W.W.O.; T.D. 5,425 ft.; P.B. 5,409 ft.; reperf. 5,394-98 ft.; swbd. 54 bbls. oil first 8 hrs. on ⅛-in. ck. and few hds. S.W.; went dead.
Bridwell Oil Co. No. 5 Anciro, Santos Flores Gr. No. 25. Comp.; 107 B.P.D.; 7-in. csg. 4,730 ft.; T.D. 4,763 tf.
Bridwell Oil Co. No. 6 Anciro, Santos Flores Gr. No. 25. R.U.
Burton Drlg. Co. No. 1 Southland Life, Blk. 12, Sweden Farm Lots. D.S.T. 4,-791-4,823 ft.; tstd. mud; drlg. plugs.
Ellmag Oil Co. No. 1 Pope, Rains Sur. E.D. 2,731 ft.; acidized.
Frank Gravis Oil Co. No. 5-A Puig, 100-ac. tr., San Andres Gr. T.D. 4,810 ft.; tstg. oil sds. 4,756-66 ft. and 4,806-10 ft.; comp.; 100 B.P.D. on ⅛-in. ck.
Frank Gravis Oil Co. No. 1 Valleo San Andres Gr. Set csg. 516 ft.; W.O.C.
Gravis & Doran No. 7 Puig, San Andres Gr., sec. 24. R.U.
E. J. Koeugh No. 2 Tiller, Hinds Sur. Spudding.
Martel Pet. Co. No. 1 Gray, Hinds Sur. R.U.
Reynosa Oil Co. No. 6 Wilson, 80-ac. tr., sec. 9. Set csg.; tstg. oil sd. 4,782-86 ft.; 7-in. csg. 4,780 ft.; comp.; 120 B.P.D.; ¼-in. ck.; T.D. 4,791 ft.
Reynosa Oil Co. No. 7 Wilson, sec. 9, Sweden Farm Lots. Set 7-in. csg. 4,773 ft.; W.O.C.
Russ Pet. Co., Inc., No. 9 Farias, sec. 9, Sweden Farm Lots. Sd. 4,796-4,803 ft.; set csg. 4,792 ft.; comp.; 224 B.P.D., ¼-in. ck.
Russ Pet. Co. No. 10 Farias, sec. 9, Sweden Farm Lots. Set csg. 4,811 ft.; W.O.C.
Russ Pet. Co., Inc., No. 2 Rossi, sec. 10, Sweden Farm Lots. T.D. 5,370 ft.; P.B. and comp.; gasser.
Standard Oil Co. of Kans. No. 5 Parr. 80-ac. tr., San Andres Gr. Sd. 4,744-68 ft.; completing.
Standard Oil Co. of Kansas No. 6 Rossi, Santos Flores Gr. Sd. 4,782-95 ft.; completing.
Standard Oil Co. of Kansas No. 4 Southland Life, sec. 12, Santos Flores Gr. T.D. oil sd. 4,821 ft.; set csg. 4,810 ft.; completed; no ga.
Woodley Pet. Co. No. 1 West, Sweden Farm Lot No. 10. Sd. 5,354-64 ft.; T.D. 5,378 ft.; set csg. 5,359½ ft.; washing in.

Charamousca—Duval County

N. V. Duncan No. 16 Worden-Drought, Sur. 151. Oil sds. 1,506-42 ft. and 1,580-81 ft.; set 7-in. csg. 1,700 ft.; W.O.C.

Colmena—Duval County

Conservative Oil Co. No. 3 D.C.R.C., Sur. 47. T.D. 1,488 ft.; comp.; gasser; W.P. 435 lbs.

Driscoll—Duval County

Continental Oil Co. No. 19 Sevier, Sur. 448. Sd. 3,600-18 ft.; set 7-in. csg. 3,-614 ft.; comp.; 48 B.P.D. on ¼-in. ck.
Continehtal Oil Co. No. 20-A Sevier, Sur. 448. Drlg. 223 ft.

Hoffman—Duval County

Cox & Hamon No. 31 Green, Sur. 118. Oil sd. 2,737-40 ft.; T.D. oil sd. 2,740 ft.; comp.; 25 B.P.D. on ½-in. ck.; 7-in. 2,739 ft.
Cox & Hamon No. 1 Cuellar, Sur. 117. O. sd. 2,693-2,713 ft.; comp.; 75 B.P.D.; ½-in. ck.
Cox & Hamon No. 29 Green, Sur. 118. Sd. 2,798-99 ft.; comp.; 197 B.P.D.; ¼-in. ck.
Cox & Hamon No. 30 Green, Sur. 118. Drlg. 2,006 ft.
Cox & Hamon No. 1 Points, Sur. 117. M.I.M.
Gulf Stream Oil Co. No. 6-B Hoffman, Sur. 118. Spudded; set 10-in. csg. 20 ft.; W.O.C.
Gulf Stream Oil Co. No. 5-B Hoffman. Sur. 118. Set 7-in. csg. 2,771 ft.; perf. 2,787-91 ft.. P.B.; W.O.C.
F. T. Oil Co. No. 1 Sutherland, Sur. 122. D.&A. 2,750 ft.

Kohler—Duval County

Bunn Bros. & Coates No. 2-A Peters, Gibson Sur. 397. Sd. 1,835-45 ft.; shut in; tested gas; set 5½-in. csg. 1,834 ft.

Labbe—Duval County

Magnolia Pet. Co. No. 10 Labbe, Sur. 1. Sd. 2,848-52 ft.; swbg.

Loma Novia—Duval County

Rodney DeLange No. 10 Wright, Sur. 72. R.U.

Lundell—Duval County

Govt. Wells Oil Co. No. 10 Lundell, Sur. 140. T.D. sd. 1,522 ft.; comp.; 140 B.P.D.
Govt. Wells Oil Co. No. 11 Lundell, sec. 140. Cg. 1,519 ft.

Peters—Duval County

Gier & Kone No. 2 Peters, Sur. 38. Cg. 2,617 ft.
Shell Pet. Corp. No. 13 B.C.C., Sur. 59. R.U.

Piedra Lumbre—Duval County

Magnolia Pet. Co. No. 9 D.C.R.C., Sur. 203. Drlg. 1,417 ft.

Seven Sisters—Duval County

Rudco O. & G. Co. No. 1 Ellis, Sur. 308. Drlg. 907 ft.

Sweden—Duval County

Hiawatha O. & G. Co. No. 3 Miller, sec. 24, Flores Gr. No. 25. T.D. sd. 5,873 ft.; show gas and dist.; prep. test.
Wellington Oil Co. No. 8-D Welder, Sur. 381. Cole sd., oil, 1,719-20 ft.; D.S.T. 1,714-20 ft.; rec. 1,700 ft. P.L.O. 8 min.; W.P. 50 lbs.; set 7-in. csg. 1,714 ft.; W.O.C.

Thomas-Lockhart—Duval County

Lockhart Bros. No. 1 Rogers, Sur. 277. Drlg. 3,437 ft.
Taylor Pet. Co. No. 1 Parr, 40-ac. tr., Sur 279. Oil and gas sd. 4,699-4,707 ft.; oil sd. 4,724-25 ft.; set plug 4,642-4,884 ft.; T.D. 5,162 ft.; W.O.C.

Pearsall—Frio County

Amerada Pet. Corp. No. 8 Halff & Oppenheimer, S. A. Ditch Sur. 1,104 (W.O.). Set 7-in. protective csg. 10,341 ft.; P.B. 5,580 ft.; acdzg.
Amerada-Rycade No. 1 Melms, A.C.H.& B. Sur. No. 1. R.U.

Darst Creek Extn.—Guadalupe County

Gulf Oil Corp. No. 7 Dix, Robinson Sur. T.D. 2,525 ft.; R.U. pump.
D. A. Kramer No. 1 Anderson, Darst Sur. Drlg. sh. 2,273 ft.
Riddle Oil Co. No. 2 Williams, DeWitt Sur. No. 13. Set csg. 2,378 ft.; S.D.
Texas Co. No. 3 Dowdy, Darst Sur. Drlg. L. 2,530 ft.
Trio Oil Co. No. 3 Wille, J. C. Darst Sur. Drlg. 1,437 ft.

Luling—Guadalupe-Caldwell Counties

Diamond Halff Oil Co. No. 1 McKean, Nancy Reaville Sur. T.D. 2,256 ft.; T.C. 1,820 ft.; P.B. 2,050 ft.; bailing oil and acid.
Muckelroy & Schawe No. 1 King, N. Renville Sur. Set 5½-in.; R.U. pump; T.D. 2,103½ ft.
Potter P. L. Co. No. 1 Cartwright, J. Henry Sur. T.D. 1,991 ft.; T.C. 1,781 ft.; 5½-in. csg. 1,770 ft.; pumping oil and wtr. with no ga.
Spokane O. & G. Co. No. 1 Hibbits, J. Henry Sur. Drlg. L. 2,160 ft.
Rio Bravo Oil Co. No. 17-L Merriweather, John Henry Sur. Spd.
Taylor Ref. Co. No. 2 Harris, H. Cottle Sur. Crevice 2,002-06 ft.; set csg.; W. O.C.; T.D. L. 2,113 ft.

Nash Creek—Guadalupe County

F. M. Gallagher No. 1 Howell, J. Darst Sur. Loc.

Zoboroski—Guadalupe County

Skivereen Oil Co. No. 2 State, Guad. River bed. D.&A. 2,250 ft.

LaBlanca—Hidalgo County

Dee Davenport No. 1 Hidalgo Wtr. & Imp. Dist., Lot 16, Engleman Subd., Smith Sur. 262. G. sd. 7,879-8,005 ft.; T.D. 8,005 ft.. perf. 7,906-16 ft.; 120 B.P.D. on ½-in. ck.
Gulf States Oil Co. No. 2-A Delta Orchards, Lot 3, Sur. 94. Drlg. hd. sh. 3,-917 ft.

Samfordyce—Hidalgo-Starr Counties

Fohs Oil Co. No. 1 Guerra, 25-ac. tr., Tr. 254, Porc. 40. Drlg. 2,217 ft.
Graham et al No. 2 Villareal, 26-ac. tr., Porc. 38. Drlg. 2,307 ft.

Alworth—Jim Hogg County

French Oil Corp. No. 6 Garcia, Sur. 269. T.D. 1,063 ft.; flwg. 1 B.P.D.; sds. 1,-034-36 ft. and 1,038-49 ft.; D.&A.

Las Animas—Jim Hogg County

Darby Pet. Co. No. 1-A Holbien, Blk. 61. sec. 6, Holbien Subd., Las Animas Gr. Drlg. 3,767 ft.

West Premont—Jim Wells County

Smith & Story No. 1 Dansard, C Lots 16 and 17, sec. 72. T.D. 2,667 ft.; S.D. rep.
Homer Presnall No. 1 Holmes, Lots 59 and 70, sec. 76. T.D. 2,259 ft.; D.S.T. rec. 50 ft. oil 4½ min.; set csg. 2,257 ft.; S.D.; W.O.O.

North Pettus—Karnes-Goliad Counties

Diamond Halff Oil Co. No. 1-A Gillette, Gomez Sur., Abst. 125. O.W.W.O.; R.U. to D.D.
Magnolia Pet. Co. No. 19 Porter, B.&B. Sur. Oil sd. 3,673-87 ft.; set 7-in. csg. 3,675 ft.; bailing; T.D. 3,687 ft.

South Burnell—Karnes County

W. J. Goldston No. 1 McKinney, Ballard Sur. Set csg. 310 ft.; W.O.C.
Luling O. & G. Co. No. 7 Boyce, Samson Still Sur. No. 8. Oil sd. 3,640-44 ft.; T.D. 3,657 ft.; comp. 315 B.P.D.
Luling O. & G. Co. No. 8 Boyce, Still Sur. Completing; T.D. 3,659 ft.
Luling O. & G. Co. No. 9 Boyce, Still Sur. Skdg. on.

Oakville—Live Oak County

Simmons O. & G. Co. No. 3-B Reagan, Romero Sur. Oil sd. 2,813-16 ft.; rng. csg.

Chittim—Maverick County

Texas Gas Service Co. No. 6 Chittim, O.W.W.O.; O.T.D. 5,592 ft.; sdtrk. 5,400 ft. to recomp. in Glenrose.

Ezzell—McMullen County

Harry Ezzell No. 5-A fee, sec. 21, Sd. 1,-518-27 ft.. set csg. 1,530 ft.; W.O.P.
Harry Ezzell No. 7-A fee, sec. 21. Sd. 1,-489-1,500 ft.; set csg. 1,510 ft.; W.O.P.
Harry Ezzell No. 1-C fee, sec. 20. Sd. 1,-474-84 ft.; set csg. 1,497 ft.; W.O.P.
Harry Ezzell No. 2-C fee, sec. 20. Sd. 1,-459-66 ft.; set csg. 1,493 ft.; W.O.P.
L. Glasscock No. 1 Bonham, Gloreck Sur., Lot 2431. Oil sd. 1,460-70 ft.; set csg.; T.D. 1,471 ft.; comp.; pump 168 B.P.D.
L. Glascock No. 2 Bonham, Floreck Sur. Oil sd. 1,448-58 ft.; T. csg. 1,448 ft.; W.O.P.
R. P. Holland No. 3 Matkin, Lot 2433. Oil sd. 1,500-10 ft.; 7-in. 1,482; T.D. sh. 1,512 ft.
Sure Oil Co. No. 2 Gayle, Lot 2434. Spd

South Cailliham—McMullen County

Bill Howard No. 9 Claunch, Hely Sur. S.D. S.W. sd. 1,236 ft.; S.D.

Taylor—Medina County

R. J. Taylor No. 3-A fee, Sur. 135. Drlg. 37 ft.

Agua Dulce—Nueces County

Texon Roy. Co. No. 3 Driscoll-Sevier, Chapman Part., Palo Alto Gr. Drlg. 3,-253 ft.
Union Prod. Co. No. 1 Galliday, Agua Dulce Gardens Subd., Benton Pastures. Drlg. 1,877 ft.

Clara Driscoll—Nueces County

O. W. Killam No. 5 Elick, 86-ac. tr., sec. 109, Pauls Subd. D.S.T. 4,650-54 ft.; rec. 1,000 ft. of 31.6-grav. oil; 55 lbs. W.P. 12 min.; cd. to 4,690 ft.; sd. 4,-650-61 ft.; 7-in. csg. 4,690 ft.; comp.; 151.2 B.P.D. on 5/32-in. ck.; perf. 4,642-51 ft.

S. Clara Driscoll—Nueces County

Sun Oil Co. No. 1 Flynn, sec. 110, Paul Subd., Driscoll ranch. D.S.T. 3,928-38 ft.; rec. 2,140 ft. fluid incl. 450 ft. P. L.O. and 1,540 ft. oily mud and 120 ft. S.W.; sd. 3,930½-38½ ft.; perf. 3,930-33 ft.; comp.; 216 B.P.D. fluid, 15% S.W.

Flour Bluff—Nueces County

Humble O. & R. Co. et al No. 2 Collier. Set csg. 6,652 ft.; comp.; 170 B.P.D.; ⅛-in. ck.
Humble O. & R. Co. et al No. 3 Collier, Lot 31, Blk. 48. Drlg. sh. 1,057 ft.
Humble O. & R. Co. et al No. 2 Dunn, Lot 8, Blk. 41. D.&A. 6,760 ft.
Humble O. & R. Co. No. 7 Gulden, Lot 23, Blk. 47. Set csg. 6,656 ft.; W.O.C.
Humble O. & R. Co. et al No. 1 Smith, Lot 9, Blk. 49. T.D. 6,660 ft.; comp.; 176 B.P.D., ⅛-in. ck.
Humble O. & R. Co. No. 2 Smith, Lot 2, Blk. 49. Set csg. 1,030 ft.; W.O.C.
Humble O. & R. Co. No. 9 Webb, Lot 8, Blk. 56. T.D. 6,656 ft.; tstg.
Humble O. & R. Co. et al No. 2-A Thompson, Lot 4, Blk. 56. R.U.

Luby—Nueces County

Seaboard Oil Corp. No. 4 Luby, Blk. 4, Sh. 2, Luby Subd. Oil sd. 5,030-57 ft.; set csg. and perf. 5,052-55 ft.; T.D. 5,-063 ft.; oil sd.; D.S.T. 5,043-63 ft.; rec. 300 ft. oil; no wtr.. 15 min.; 400 lbs.; comp.; 130 B.P.D., ⅛-in. ck.; sd. 5,047-57 ft.; set 7-in. csg. 5,057 ft.
Seaboard Oil Corp. No. 6 Luby, Blk. 2, Sh. 4, Luby Subd. Sd. 5,043-73 ft.; set 7-in. csg. 5,073 ft.; W.O.C.
Seaboard Oil Corp. No. 2 Shaeffer, Sh. 3, Blk. 2, Luby Subd. Drlg. 817 ft.
Stanolind O. & G. Co. No. 4 McCann, Falcon Sur. M.I.M.

Saxet Heights—Nueces County

Crown Central Pet. Corp. No. 6 Page, 75-ac. tr., Page Lds. Sur. Sd. 4,407-13 ft.; 7-in. csg. 4,397 ft.; W.O.C.
J. E. Freeman No. 1 Kovner, Sur. 416. Drlg. 4,586 ft.
Greta Oil Corp. No. 1 Isensee, Sur. 404. T.D. 4,910 ft.; perf. 4,893-4,903 ft.; tstd. gas; plgd. and reperf.; flwg. O.&G.
Greta Oil Corp. and Morgan No. 8 Morgan-Clark, Sur. 405. T.D. 1,160 ft.; S.D.; W.O. material.
Hiawatha O. & G. Co. No. 14 Hutchins-Stillwell Sur. 500. Drlg. 6,053 ft.
Houston Oil Co. No. 5-A Harrell, Sheppard Farm Lots. Set csg. 4,847 ft.; W.O.C.; T.D. 6,999 ft.; P.B. and perf. 4,526-32 ft.; comp.; est. 20,000,000 ft. gas; C.P. 1,800 lbs.; T.P. 1,775 lbs.
Houston Oil Co. No. 5 Hunter, 75-ac. tr., sec. 8, Rge. 7. Oil and gas sd. 4,797-4,815 ft. and 4,857-60 ft.; prep. to set csg.
Houston Oil Co. No. 13 McGregor, Sur. 582. M.I. rig.
Houston Oil Co. No. 29 Morgan, sec. 7, Rge. 6. Set csg. 4,857 ft.; comp. 100 B.P.H., ¼-in. ck.; Sd. 4,852-57 ft.
Houston Oil Co. No. 30 Morgan, sec. 7, Rge. 6. Spdd.; W.O.C.; 16-in. csg. 211 ft.
Houston Oil Co. No. 33 Morgan, sec. 7, Rge. 6. Drlg. 1,449 ft.

H. H. Howell No. 7 Hutchins, 80-ac. tr., Sur. 416. Drlg. 5,507 ft.
J. K. Kepley Prod. Co. No. 9 Donigan, sec. 7, Rge. 6. Set 16-in. condr. csg. 148 ft.; drlg. 1,050 ft.
Maryland Corp. and Renwar Oil Co. No. 2-B Morgan, Sur. 415. Cg. 6,907 ft.
Maryland Corp. et al No. 3 Stillwell-Sagarin Sur. 500. R.U.
North Star Oil Co. No. 12-E Morgan, sec. 405. Sd. 6,700-53 ft.; set csg.; T.D. 6,946 ft.; P.B. 6,700 ft.; perf. 6,702-10 ft.; comp.; 5 B.P.H., dist., 7/32-in. ck.
Daniel McGahey No. 1 Cody, 40-ac. tr., Smith Sur. 25. Drlg. 1,657 ft.
Pan American Prod. Co. No. 2-B Sagarin, Sur. 500. O.W.W.O.; old T.D. 5,827 ft.; perf. 6,896-6,901 ft.; reperf. 6,909-13 ft.; comp.; 207 B.P.D. on 5/32-in. ck.; top pay 1,025 ft.
Richardson Pet. Co. No. 3 Harrell, Blk. 33, Sheppard Farm Lots. Set csg. 6,996 ft.; perf. 6,970-74 ft.; swb. dry; S.D.; W.O.O.
Richardson Pet. Co. No. 7 Perkins-Lagasse, Blk. 25, Sheppard Farm Lots. Drlg. 6,487 ft.
Richardson Pet. Co. No. 13 Quiros, Sur. 311. Sd. 6,905-60 ft.; sqz. perf. 6,907-12 ft.; tstd. wtr.; W.O.C.
Richardson Pet. Co. No. 11 Sedwick, 184 ac. tr., Dunn Sur. 312. T.D. 7,380 ft.; P.B. 5,000 ft.; W.O.C.
Southern Minerals Corp. No. 9 Ocker, 205-ac. tr. Set 7-in. csg. 4,863 ft.; sd. 4,862-71 ft.; jetting oil; no show.
Texon Drlg. Co. No. 5 Vance, Gallagher Sur. O.W.W.W.O.; old T.D. 6,924 ft.; T.D. 9,229 ft.; P.B. to test 6,900 ft.; killed to rework.

Stratton—Nueces County

Camp Prod. Co. No. 3 Wardner, sec. 12, Stratton Ranch Subd. Set csg. 1,080 ft.; W.O.C.

Midway—San Patricio County

Sun Oil Co. No. 2 Coggin, sec. 82. Oil sd. 5,333-35 ft.; set csg.; T.D. 5,338 ft.; comp.; 146 B.P.D. on 9/64-in. ck.; 20% S.W.; T.P. 420 lbs.; C.P. 790 lbs.
Sun Oil Co. No. 3 Coggin, Paul Subd Pits.

Plymouth—San Patricio County

Heep Oil Corp. No. 8-F Welder, sec. 46. P.B. and set csg. 6,015 ft.; perf. 5,919-23 ft.; T.D. 7,253 ft.; comp.; 65 B.P.D., dist., ¼-in. ck.; T.P. 1,400 lbs.
Magnolia Pet. Co. No. 13 Corpus Christi Bank & Trust, H.H. Hunter Sur. Drlg. 4,057 ft.
Plymouth Oil Co. No. 84-C Welder, sec. 70. Oil sd. 5,512-15 ft.; set 7⅝-in. csg. 5,528 ft.; comp.; 152 B.P.D. on ⅛-in. ck.; C.P. 1,300 lbs.
Plymouth Oil Co. No. 85-C Welder, sec. 70. Oil sd. 5,467-77 ft.; perf. 5,472-77 ft.; comp.; 198 B.P.D. on 9/64-in. ck.; T.D. 5,491 ft.
Plymouth Oil Co. No. 86-C Welder, sec. 70. Set csg. 366 ft.; W.O.C.
Plymouth Oil Co. No. 87-C Welder, sec. 70. Drlg. 4,318 ft.
Plymouth Oil Co. No. 88-C Welder, sec. 70. Set 367 ft. csg.; W.O.C.
Sun Oil Co. No. 3 Roundtree, sec. 34, Lot 4. Perf. 5,636-37 ft.; pmpd. 30 bbls. oil, 50 bbls. S.W.; sanded up; cutting and plg. tbg.

Taft Field—San Patricio County

Humble O. & R. Co. No. 4 Flinn, R. Ross Sur. Set csg. 3,985 ft.; comp.; no ga.
Humble O. & R. Co. No. 32 Mayo, Ottman Sur. Drlg. sh. 2,295 ft.

Barbaceas—Starr County

K. E. Merren No. 1-A S.C.C.C., Blk. 34 Lambeth Subd., Porc. 89. Set csg. at T.D. 5,640 ft.; sd. 5,470-91 ft.; C.O.; perf. 5,300-5,417 ft. and 5,417-24 ft.; flwg. dist. and S.W.; C.I.C.P. 1,800 lbs. stdg.

Ricaby—Starr County

Conan Wood No. 3 Wardner Est., Porc. 84. S.D. 526 ft.
Dean Bros. No. 1 Valadez, Porc. 84. Sd. 1,863-72 ft.; set 5½-in. csg. 1,872 ft.; T.D. 1,873 ft.; perf. 1,868-72 ft.; 1,200 ft. fluid mostly oil in hole; to put on pmp.
Sun Oil Co. No. 5 Wardner, Vela Sur., Porc. 84. Sd. 1,633-41.5 ft.; D.S.T. 1,624-41.5 ft.; rec. 120 ft. S.W. and mud; drlg. 1,707 ft.

Cole—Webb County

O. W. Killam No. 59 Bruni, sec. 8, Foltz Subd., Ariape Gr. Set 5¼-in. csg. 3,401 ft.; T.D. 3,415 ft.; W.O.C.
O. W. Killam No. 4 Garcia, Villareal Sur. 337. R.U.
Magnolia Pet. Co. No. 3 Valdez, Valdez Sur., Blk. 8. T.D. 3,808 ft.; rng. S.J.

Killam—Webb County

French Oil Corp. No. 4 Perez, Sur. 1107. Set csg. 1,990 ft.; T.D. 1,998 ft.; W.O.C.
O. W. Killam No. 19 Garcia, Sur. 786. Oil sd. 1,983-88 ft.; set 5½-in. csg. 1,979 ft.
Navarro Oil Co. No. 3 Perez, Blk. 15, Sur. 1,007. Drlg. 1,657 ft.
Rowan & Hope No. 3 Laurel Bros., Sur. 1006. T.D. 1,943 ft.; 7-in. csg. 1,934 ft.; W.O. pmp.

Lopes—Webb-Duval Counties

C. H. Andrus No. 1 Billings, Sur. 10. Set 5½-in. csg. 2,262 ft.; perf. csg.; tstg.

O'Hern—Webb County

C. H. Callahan No. 1 Benavides, Blk. 18, Hale Subd. S.D. 900 ft.

Oilton—Webb County

Bridwell Oil Co. No. 8 Martin, Sur. 2167. T.D. 1,905½ ft.; oil sds. 1,880½-1,905½ ft.; comp.; 142 B.P.D.; pumping.
Bridwell Oil Co. No. 9 Martin, Sur. 2167. Oil sd. 1,905-06½ ft.; set 7-in. csg. 1,901 ft.; W.O.C.; T.D. 1,908 ft.
Bridwell Oil Co. No. 2-A Martin, Sur. 2167. Drlg. 1,856 ft.
Cox & Hamon No. 1 Martin, Blk. 22, Sur. 1105. Drlg. 1,757 ft.
Gypsy Oil Co. No. 3-A Martin, Sur. 2167. Oil sd. 1,883-1,914 ft.; W.O. pump.
Gypsy Oil Co. No. 4-A Martin Sur. 2167. Comp.; 151.12 B.P.D.; pmp.; oil sd. 1,923-28 ft.
Gypsy Oil Co. No. 5-A Martin, Sur. 2167. Oil sd. 1,912-21 ft.; set 5½-in. csg. 1,912 ft.; W.O.C.
Hamil & Smith No. 5 Martin, Sur. 2167. Drlg. 1,518 ft.
Hamil & Smith No. 16 Martin, Sur. 2167. 7-in. csg. 1,883 ft.; comp.; 60 B.P.D.
Hamil & Smith No. 20 Martin, sec. 2167 Set csg. on sd.; Comp.; 26 B.P.D., flg.; oil sds. 1,860-62 ft. and 1,876-85 ft.
Magnolia Pet. Co. No. 2 Sprague-fee, Sur. 2161. Comp.; 20,000,000 ft. gas; T.D. 1,878 ft.
Mills Bennett Prod. Co. No. 2 Martin, Sur 2167. D.&A. 2,568 ft.
Porter & Blanchard No. 2 Laurel Bros., Sur. 1006. Drlg. 2,358 ft.
Rowan & Hope No. 6 Laurel Bros.. Sur. 1006. Set csg. 1,945 ft.; comp.; 131 B. P.D. on 18/64-in. ck.
Rowan & Hope No. 7 Laurel, Sur. 1006. Sd. 1,918-23 ft.; comp.; 150 B.P.D. on pump; 7-in. csg. 1,918.

LaSal Vieja—Willacy County

Shell Pet. Corp. No. 2 Yturria, Sh. 64. Carricitos Gr. Cg. sh. and sd. 7,735 ft.

Escobas—Zapata County

Dulup Oil Co. No. 29 Trevino, Sur. 412, Blk. 25. D.&A. 1,113 ft.
Texas Co. No. 110 Jennings, Cerrito Blanco Gr. Set 7-in. csg. 1,227 ft.; T.D. 1,248 ft.; W.O.C.

Lopena—Zapata County

Wm. Winn No. 1 Ramirez, Sh. 2. Jamieson Subd., Porc. 19. Drlg. 1,423 ft.

Batesville—Zavalla County

Wilcox O. & G. Co. No. 2 Gillam, G.W.T. &P. R.R. Sur. R.U.

EAST TEXAS

(Border Counties)

Cass County

American Liberty Oil Co. No. 5 Maxie John Collom Sur. Comp.; flw. 137 B. P.D.; T.D. 5,905 ft.
Ark. La. Gas Co. No. 1 Neilon, Thomas Gillespie Sur. Cg. 5,830 ft.
Bay Oil Corp. No. 4 Cobb, G. Crowder Sur. Drlg. 2,213 ft.
W. C. Feazel No. 1 Parker, G. Crowder Sur. Drlg. 3,914 ft.
R. W. Norton No. 3 W. E. Starke. Comp.; flw. 130 B.P.D.; T.D. 6,025 ft.
R. W. Norton No. 4 W. and E. Starke, D. Gillam Sur. Comp.; flw. 80 B.P.D.; T.D. 6,050 ft.
Union Prod. Co. No. 5 fee 575, B. Holmes Sur. Drlg. 3,480 ft.
Union Prod. Co. No. 4 J. S. Hall, J. N. Jackson Sur. Drlg. 5,416 ft.
Union Prod. Co. No. 2 Thrower. T.D. 6,049 ft.; tstg.
Union Prod. Co. No. 3-A Starke, D. Gilliam Sur. Drlg. 2,220 ft.
United Prod. Co. No. 4 Belote, H. Holbert Sur. Comp.; flw. 3 B.P.H.; T.D. 5,982 ft.

Marion County—Rodessa

Arkansas-La. Gas Co. No. 1 Neilson, A. D. S. Coy Sur. Cg. 5,830 ft.
Geo. Barham No. 1 Whitfield, R. Bennington Sur. Drlg. 6,104 ft.
Foha Oil Co. No. 3 Mary McReynolds, A. D. S. Coy Sur. 7-in. cmt. 6,133 ft.; T.D. 6,149 ft.
Foha Oil Co. No. 1 W. T. Neilon, R. Bennington Sur. Loc. moved to SE cor. 70-ac. Neilon Sur. Cg. 4,655 ft.
Foha Oil Co. No. 2 M. Reynolds, A. D. S. Coy Sur. P.B. to 6,014 ft.; tstg. gas.
Gulf Prod. Co. No. 2 L. Henderson, R. Bennington Sur. Comp.; flw. 738 B. P.D.; T.D. 6,061 ft.
Heyser-Heard & Clardy No. 1 L. Henderson, R. Bennington Sur. Drlg. 5,240 ft.
Holcomb & Thomason No. 1-B L. Henderson, U. Ewing Sur. Drlg. 4,061 ft.
Mid-Continent Pet. Corp. No. 4 Sory, A. D. S. Coy Sur. Acid.
Shell Pet. Corp. No. 1 Cooke, R. Bennington Sur., 80-ac. tr. Drlg. 1,800 ft.
Shell Pet. Corp. No. 1 L. Henderson Unit, R. Bennington Sur. Drlg. 2,540 ft.
Union Prod. Co. No. 5 Hutchinson, A. D. S. Coy Sur. T.D. 5,298 ft.; fsg. for rk. bit.
Union Prod. Co. No. 3-A Starke, D. Gilliam Sur. R.U.
United Prod. Co. No. 3 Hutchinson, A. D. S. Coy Sur. 7-in. 6,065 ft.; T.D. 6,091 ft.; tstg.
United Prod. Co. No. 4 Hutchinson, A. D. S. Coy Sur. T.D. 6,145 ft.; tstg.

Panola County

Danciger O. & G. Co. No. 1 Tatum, A Bissell Sur. T.D. 6,514 ft.; perf. csg. and tstg.
Magnolia Pet. Co. No. 2 E. A. Hull, Thos Applewhite Sur. T.D. 8,717 ft.; fsg. for D.P.

WEST TEXAS WILDCATS

Andrews County

M. S. Forgeron et al No. 1 Lockhart & Brown, C NE¼ sec. 20, Blk. A-41, P.S.L. Sur. S.D. 179 ft.
Gulf Oil Corp. No. 1 State, sec. 8, Blk. 14 T.D. 4,106 ft.; W.O.C.

Bailey County

Duffey & Etz No. 1 Enochs, Tract 66, League 182, Floyd Co. School Lands Sur. Drlg. 2,112 ft.

Borden County

Continental Oil Co. No. 1-A Clayton, sec. 27, Blk. 32, Twp. 4n, T.&P. Sur. Drlg. 137 ft.

Brewster County

F. C. Dodson No. 1 Texas American Syn., sec. 66, Blk. 10, G.H.&S.A. Sur. Straight-reaming 6,018 ft.
Storey No. 1 Wilson, sec. 3, Blk. 212, T.&St.L. Sur. S.D. 2,545 ft.

Cochran County

P. N. Wiggins et al No. 1 Dean, NE cor. League 58, Martin Co. School Lands. Drlg. 4,917 ft.
Pete Wiggins et al No. 1 C. Slaughter Dean, C Lab. 26, League 92, Lipscomb Co. Sch. Ld. T.D. 5,030 ft.; shot; C.O.

Concho County

Sam Murray No. 1 R. G. Armor, sec. 105, T.&N.O. Sur. Spudded and S.D.

Coke County

Barnett Pet. Co. No. 1 J. R. Mims, sec. 39, Blk. W, T.&.P. Sur. S.D. 1,005 ft.
H. E. Ogden et al No. 1 Rawlins, sec. 390, Blk. B-21. S.D. 515 ft.

Crane County

Wilcox O. & G. Co. No. 1 McKnight, sec. 9, Blk. 46, Twp. 3s, G.M.M.B.&A. Sur. T.D. 6,177 ft.; pipe stuck.

Crockett County

Moore Bros. No. 1 P. Perner, sec. 37, Blk 2, I.&G.N. Sur. Fsg. 7,297 ft.
Stewart & Cormas No. 1 Hoover, sec. 1, Blk. FF, B.B. Sur. Drlg. 1,462 ft.

Culberson County

C. A. Jarrell et al No. 1 C. M. Caldwell, C of SW¼ sec. 15, Blk. 100, P.S.L. Sur. S.D. 151 ft.

Dawson County

R. Albaugh No. 1 D. Hogg, SE of SE sec. 17, Blk. 34, Twp. 4n, T.&P. Sur. S.D. 3,865 ft.
E. L. Wilson No. 1 Scanlon, Sec. 83, Blk M, E.L.R.R. Sur. S.D. 4,965 ft.; P.B. to 4,933 ft.; S.D.

Dickens County

C. E. Litchfield No. 1 Harris, sec. 354, Blk. 1, H.&G.N. Sur. S.D. 1,602 ft.
J. F. Morrisey et al No. 1 C. L. Bird, sec. 290, Blk. 1, H.&G.N. Sur. Drlg. 1,400 ft.

Edwards County

A. P. Carter No. 1 F. D. Sweeten, S&E sec. 48, Blk. 2, B&B Sur., 1½ mi. E o. Rock Springs. Fsg. 5,096 ft.

Fisher County

I. J. Allen No. 1 H. S. Newman, Lot 49, Bastrop Co. Sch. Lds. Drlg. 2,820 ft.
Bond Oil Corp. No. 1 N. Bertram, 1 mi. S of Sylvester. Drlg. 1,800 ft.
Consolidated Oil Co. et al No. 1 Florida. T.D. 3,220 ft.; U.R. csg.
General Crude Oil Co. No. 1 Morrow, sec. 185, Blk. 2, H.&T.C. Sur. Drlg. 2,469 ft.
Richmond Drlg. Co. No. 1 Brown, O.T.D. 3,002 ft., R.U.C.T., sec. 66, Blk. 3, G. W.T.&P. Sur. Loc.

Gaines County

American Liberty Oil Co. No. 1 N. W. Willard, sec. 38, Blk. AX. Loc.
Continental Oil Co. No. 2 Jones, sec. 1, Blk. A-8, P.S.L. Sur. Drlg. 4,700 ft.
Mitchell & Sullivan No. 1 Shell, T. S. Riley, sec. 447, Blk. G, C.C.S.D.&R.G. N.G. Sur. Drlg. 128 ft.
Shell Pet. Corp. No. 1 Robertson, sec. 344, Blk. G. Drlg. 4,072 ft.

Garza County

M. L. Richards No. 1 Slaughter. Drlg. 1,100 ft.

Hockley County

The Texas Co. No. 2 Slaughter, Labour 92, League 37, Zavalla Co. Sch. Lds. Drlg. 3,200 ft.

Howard County

W. F. McDermott et al No. 1 Lucas, sec 18, Blk. 29, Twp. 1n, T.&P. Sur., 5 mi N of Dodge pool. Drlg. 1,840 ft.

Hudspeth County

Haymon Krupp Oil & Ld. Co. No. 1 Thaxton, SE¼ sec. 34, Blk. 74, Twp 6 T.D. 3,235 ft., U.R. csg.
Haymon Krupp No. 1 Briggs, sec. 24, Blk 73, Twp. 7. T.&P. Sur. T.D. 1,180 ft.; W.O.C.

Jeff Davis County

H. D. Wilcox et al No. 1 Jones-Coffield S.D. 3,315 ft.; S.R.

Loving County

Barnett Pet. Co. No. 1-A Johnson, sec. 2 Blk. 57, Twp. 1, T.&P. Sur. Drlg. 2,400 ft.
Barnett Pet. Corp. No. 1-B W. D. Johnson sec. 12, Blk. 58, Twp. 1, T.&P. Sur. T.D. 3,174 ft.; P.B. to 3,131 ft.; W.O.C.
Carpenter & Grierson No. 1 Mrs. Bennie Barnes, sec. 22, Blk. C-25, P.S.L. Sur. Loc.

Martin County

J. L. Green et al No. 1 O. B. Holt, C of Labour 20, Lge. 319, Garza Co. Sch. Lds. Drlg. 3,200 ft.; top Yates 2,990 ft.

Pecos County

Adams No. 1 A. A. Gray, sec. 593, Blk. 105, G.C.&S.F. Sur., 12 miles N of Fort Stockton. Loc.
Humble O. & R. Co. No. 1 Belding et al, 9 mi. SW of Ft. Stockton. T.D. 2,451 ft.; 1,100 ft. O.I.H.; bailing.
Messenger & Osburn No. 1 Humble-Young, sec. 49, Blk. 10, H.&G.N. Sur. T.D. 1,807 ft.
R. Thompson No. 1 Elsinore Cattle Co., sec. 54, Blk. D, G.C.&S.F. Sur. Drlg. 6,000 ft.
Thompson & Minshall No. 1 Michaelson, 660 ft. N and W, sec. 24, Blk. 146, T.&St.L. Sur. Drlg. 480 ft.
Wilcox O. & G. Co. No. 1 Serf, sec. 27, Blk. 130, T.&St.L. Sur. Loc.

Presidio County

L. C. Brite No. 4 fee, C NW¼ sec. 113, Blk. 12, G.H.&S.A. Sur. Drlg. 4,375 ft.

Reeves County

Barnett Pet. Corp. No. 1 Ely, sec. 38, Blk. 71. P.S.L. Sur., 12 mi. NW of Toyah. S.D. 1,530 ft.; to set csg.

Runnels County

Homer Price No. 1 Beddo, sec. 51, Thompson Casey Sur. T.D. 2,015 ft.; U.R. csg.
K. Z Oil Co. No. 1 B. Fletcher, E. C. Good Sur. Drlg. 4,112 ft.
Stephenson & Glober No. 1 Fowler, sec 150, E.T.R.R. Sur., 2 mi. NE of Ballinger. T.D. 1,095 ft.; S.D.

Schleicher County

J. M. Cooper No. 2 B. Page, sec. 40, Blk. L, G.H.&S.A. Sur. T.D. 4,710 ft.; drlg. by csg.
Tex-Tor Oil Corp. No. 1 Judkins & Spencer, C of SW¼ sec 33, Blk. A, A.&B. Sur. T.D. 3,755 ft.; C.O.

Scurry County

Robinson Drlg. Co. No. 1 Martin, sec. 147, H.&T.C. Sur. Drlg. 2,760 ft.
T. G. Shaw Oil Co. No. 1 First Natl. Bank. Drlg. 2,412 ft.; no report.

Sterling County

Wilcox O. & G. Co. No. 1 Kinnebrew Est., sec. 101, Blk. 2, H.&T.C. Sur. Drlg. 2,924 ft.

Sutton County

Ordovician Oil Co. No. 1 Evans, sec. 1, L. Stubblefield Sur., 32 mi. SE of Sonora. S.D. 3,475 ft.

Terrell County

D. & S. Oil Co. No. 1 Sam Bell. S.D. 345 ft.

Tom Green County

Humble O. & R. Co. No. 1 Lewis & Wardlaw, sec. 5, Blk. 17, H.&T.C. Sur. Fsg. 1,545 ft.

Upton County

Rutter et al No. 1 Egolb, sec. 5, J. H. Gibson Sur. Drlg. 800 ft.

Ward County

L. F. White et al No. 1 Rector-Monroe, E cor. sec. 3, Blk. 1, W.&N.W. Sur. Top Del. L. 4,635 ft.; top Del. sd. 4,670 ft.; T.D. 4,710 ft.; ran tbg.

Yoakum County

American Liberty Oil Co. No. 1 A. C. Thomas, 2,227 ft. S and 440 ft. W, sec. 864, Blk. D. R.U.R.
American Liberty Oil Co. No. 1 Claywater. T.D. 5,083 ft.; S.I. for storage.
J. W. Murchison et al No. 1 Sawyer, SE¼, sec. 702, Blk. D. Cellar.
Denver Prod. & Ref. Co. No. 1-A Whittenburg, sec. 830, Blk. 4. T.D. 4,546 ft.; W.O.C.
J. I. Greene et al No. 1 Nevels, sec. 709, Blk. D. Drlg. 5,167 ft.
Skelly and Sun Oil Co. No. 1 Kiser, sec. 640, Blk. D. T.D. 4,600 ft.
Standard of Texas No. 1 M. B. Sawyer, sec. 576, Blk. D, J. H. Gibson Sur. T.D. 5,403 ft.; C.O.
Texas Co. No. 1 Walker, sec. 794, Blk. D El. 3,656 ft.; T.D. 5,180 ft.; P.B. to 5,162 ft.; shot; acid.; swbg. oil and wtr.
P. N. Wiggins et al No. 1 Bartlett, sec. 359, Blk. D. S.D. 3,023 ft.

E. C. TEXAS WILDCATS

Anderson County

Humble O. & R. Co. No. 1-C Southern Pine Lbr. Co. Drlg. 7,550 ft.

Angelina County

J. C. Bonham No. 1 Cameron Lbr. Co., E. Miller Sur., 3 mi. SE of Zavilla. Loc.
John Coates No. 1 J. L. Russell, Jose Morino Sur., E of Diboll. Drk.

Bowie County

King Oil Corp. No. 1 W. W. Ames, 800 ft. S and 1,650 ft. E of J. A. Tolbott Sur., 4½ mi. NW of Texarkana. Pits.

Cherokee County

J. G. Mays No. 1 Holmes, 330 ft. most northerly NE cor. of 108 acres, S. F. L. Noble Sur. D.S. stuck 840 ft.
Merica Oil Co. No. 1 Cherokee Dev. Co., A. J. Acker Sur., 2 mi. E of Maydelle. Drk.
E. H. Moore, Inc., No. 1 Chronister Lbr. Co., 6 mi. N and E of Wells, Tr. 71, Blk. 33, John Durst Gr. Drlg. 5,736 ft.

Falls County

McCleod et al No. 1 F. Bolton, J. R. Cockrill Sur., 4 mi. NW Rosebud. Fsg. 1,708 ft.

Freestone County

C. E. Rossiter No. 1 J. P. Fulton in J. P. Fulton Sur., 2½ mi. E of Donie. S.D. 956 ft.

Gregg County

Humble O. & R. Co. & Gulf O. Corp. No. 1 E. Robertson, M. Mann Sur., 2½ mi. SW of Longview Trinity test. El. 272 ft.; Glen Rose 4,876 ft.; cg. 6,800 ft.; 500,000 ft. gas 6,564-6,678 ft.

Henderson County

E. B. LaRue et al No. 1 Breedlove & Mills, J. Dunn Sur., 5 mi. NW of LaRue. M.I.M.

Wm. McDougall No. 1 Trinity, F. & S. Land Co., Blk. 1, H.&T.C. Sur. Drk.

Tide Water Assoc. et al No. 2-C McElreath & Suggett. W. P. Wyche Sur. T.D. 9,320 ft.; P.B. to 9,255 ft.; est. 15,000,000 ft. gas; S.D.

Hill County

J. Willis No. 1 W. P. Ball, S. Marshall Sur., 3 mi. NW of Covington. M.I.M.

Leon County

Kelly & Fox No. 1 Bryant, A. M. Coultern Sur., 1 mi. E of Marquez. S.D.

Limestone County

C. L. Brown No. 27 N. B. Boyd, R. B. Longbotham Sur., 3 mi. S of Wortham. T.D. 1,107 ft.; set csg.

Pur. Oil Co. No. 16-1 Kendrick, P. Varella Sur., Mexia field. T.D. 8,847 ft.; D.S. stuck.

Stanolind O. & G. Co. No. 1 T. Norris, in Thresher Sur., 5 mi. N of Kosse: 6,500-ft. test; ele. 528 ft.; cg. 5,543 ft.

Navarro County

Nowlin et al No. 1 Easterling, J. Mayor Sur., 2 mi. S of Chatfield. Drlg. 975 ft.

Mrs. Jane Robinson No. 1 Fortson Bros., Eli Smith Sur., 5 mi. NE Corsicana. S.D. 1,001 ft.

T. Sharpe et al No. 1 E. B. McDowell, T. Jordan Sur., 1½ mi. S of Bassets. Austin ck. 2,835-2,935 ft.; S.D. 2,970 ft.

Rusk County

J. W. Shipman et al No. 1 Citizens Bank, J. J. Y'Barbo Sur., 4 mi. NE of Henderson. S.D. 4,500 ft.

NORTH TEXAS WILDCATS

Archer County

E. C. Norwood et al No. 1 W. P. Ferguson, sec. 4, F. Peterswick Sur. A-343. R.U.R.

Baylor County

Hampton et al No. 1 A. G. Cochrell, sec. 2,404, T.E.&L. Sur. S.D.O. 1,385 ft.

Clay County

W. Gant No. 5 C. M. Worsham, D.L.&C.A. Sur. 1073. Tstg.

Healdton O. & G. Co. No. 1 Wallace, Belcher Subd. Drlg. 1,623 ft.

Cooke County

W. O. Russell No. 1 J. W. Sherrill, Wm. Phelps Sur. A-821. Drlg. 1,575 ft.

Denton County

W. C. Curry et al No. 1 G. F. Owens, N. Rudder Sur. A-1060. S.D.O. 620 ft.

Bruce Lee No. 1 Boyles, S. Ross Sur. A-112. S.D.O. 1,733 ft.

Scroggins et al No. 1 S. M. Freeman, Bradshaw Sur. A-104. S.D.O. 2,185 ft.

Wells-Dodson-Pearson No. 1 Hughes, B.B.B.&C. Sur. A-1252. S.D.O. 2,200 ft.

Foard County

Texas Co. No. 14 Johnson, sec. 37, S.P. R.R. Sur., Blk. L. Drlg. 1,300 ft.

Grayson County

Denver P. & R. No. 1 Cannon, A. Berry Sur. A-130. Will Lane perf. pipe and test upper sd.

Pearson Tubing Co. No. 1 J. H. Thompson, W. A. Warner Sur. A-1350. Drlg. 1,450 ft.

Montague County

J. W. Sorrell et al No. 1 J. E. Walthall, Sam H. Smith Sur. A-662. Drlg. 2,275 ft.

Wichita County

Grace & Woods No. 1 W. L. Hodges, H. B. Balch Sur. A-26. 6⅝-in. 3,720 ft.; W.O.C.

Hammon Hanlon Buchanan, Inc., No. 1 A. F. Fassett, sec. 1, E.T.R.R. Sur. O.S. 4,002-18 ft.; shot with 60 qts.; C.O.; est. 500 bbls.

Jack E. Kadane No. 1 C. A. Mangold, P. Castleman 35-A. 6⅝-in. cmtd. 3,650 ft.; R.U.S.; to drill plug.

King Oil Co. No. 1 T. F. Mitchell, P. Castleman Sur. A-36. Drlg. 3,600 ft.; tstg.

Lebus et al No. 1 G. W. Lewis, Blk. 20, K.W.V.L. Sur. 6⅝-in. 3,726 ft.; tstg. Show L. 3,720-49 ft.

LeBus No. 1 J. F. Miller, W. R. Eaves Sur. A-447. Fsg. baller.

Patterson et al No. 1 B. C. Ellis, J. Waldschmidt Sur. A-792. Drlg. 1,250 ft.

Felix Payne No. 1 P. R. Pace, R. J. Scott Sur. A-253. Spud. & S.D.

E. J. Stump No. 1 M. P. Bishop, L. Netherley Sur. A-240. Drlg. 2,100 ft.

E. J. Stump et al No. 1 J. and J. Waggoner, W. R. Eaves Sur. A-753. Shot with 300 qts.; C.O.

Clyde Texan Oil Fields Co. No. 1 A. W. Burnside, John M. Sharp Sur. A-262. Shot S.L. 3,935-51 ft.; P.O.P.

Wilbarger County

Barry & Hayes No. 1 McGill, sec. 3, Blk. 9, H.&T.C. Sur. S.D. 3,030 ft.

W. Little No. 1 A. P. Morris, sec. 3, H.T. &C. Sur., Blk. 14. Drlg. 1,000 ft.

W. W. Woolsey et al No. 1 Waggoner A, sec. 3, S.P.R.R. Sur. A-535. Drlg. 940 ft.

Wise County

W. D. Dilbeck No. 1 J. I. Wilkins, E. Stephens Sur. S.D. 600 ft.

Latex Oil Co. No. 1 C. R. Smith, J. Couch Sur. A-104. C.O. bridge; tstg.

Young County

C. B. Christie No. 1 S. Dozier, I. L. Hill Sur. A-126. Drlg. 2,750 ft.

L. A. Long No. 1 F. A. Burnett, E.G. Rector Sur. No. A-239, W.O.C.

W-K Royalty Co. No. 1 J. A. Wright, J. N. Taylor Sur. A-1243. Drlg. 4,100 ft.

RANGER (CENTRAL TEXAS) DISTRICT

Brown County

C. R. Cox, Tr., No. 1 Jan Lee, sec. 11, B.B.B.&C. Sur., NE cor. county. S.D. 240 ft.

S. B. Roberts No. 1 Angell, 9 mi. SE Cross Cut, B. H. Garvin Sur. Drlg. 100 ft.

Ungren & Frazier and Paul Fitzer No. 1 Cox & McInnis, sec. 88, I. S. Tabor Sur. (map shows H.T.&B. Sur.). M.I.T.

Callahan County

R. F. Gilman et al No. 1 W. A. Young, 5 mi. NW Clyde, sec. 37, B.B.B.&C. Sur. Drlg. 793 ft.

Hal Hughes No. 1 Poindexter, sec. 350, Geo. Hancock Sur., 2 mi. NE of Oplin. Drlg. 3,150 ft.

J. C. Jackson et al No. 1 Thompson, 2 mi. S. Eula, sec. 30, B.B.B.&C. Sur. S.D. 1,500 ft.

Phillips Pet. Co. No. 1 Cozart, 1 mi. NW Scranton, M. Cherry Sur. S.D. 1,595 ft.

Walker & Webb No. 1 Ross, 1 mi. NE Clyde, sec. 81, B.B.B.&C. Sur. Drlg. 1,175 ft.

Woodley Pet. Co. No. 1 Flores-Deep, 5 mi. SE Baird, sec. 149, B.B.B.&C. Sur. Drlg. 695 ft.

Coleman County

J. F. Brock No. 1 J. H. Livingston, SE cor. SW¼ county, J. D. Waters Sur. No. 208. Drlg. 190 ft.

Dixie O.&G. Co. No. 1 Reaves, 6 mi. NW Bangs, J. M. Rhine Sur. No. 629. S.D. 805 repra.

Comanche County

N. D. Gallagher et al No. 1 Mrs. B. I. Terry, Desdemona pool, N. H. Kuykendall Sur. Drlg. 4,395 ft.

Dobbs Oil Co. No. 1 Hodges, sec. 11, Blk. 2, H.&T.C. Sur. S.D. 1,370 ft.

Eastland County

G. D. Chastain et al No. 1 Weddington, 4 mi. N. Cisco, sec. 496, S.P.R.R. Sur. Drlg. 2,700 ft.

Hickok Prod. & Dev. Co. No. 1 J. E. Donovan, 5 mi. NW of Cisco, 660 ft. from N and E lines of NW¼ sec. 489, S.P. R.R. Sur. Loc.

Hickok Prod. & Dev. Co. No. 1 Van Parmer, NW cor. county, sec. 477, S.P.R.R. Sur. Rng. tbg.

J. D. Kittrell No. 1 Reynolds, 5 mi. E of Carbon, sec. 23, H.&T.C. Sur., Blk. 1. S.D. for 6-in. 900 ft.

Monark O. & G. Co. No. 1 Downtain, sec. 14 H.&T.C. Sur. Blk. 4, 3 mi. N Eastland. S.D. 2,140 ft.

Erath County

Arnold Oil Co. No. 1 McMillan, 2 mi. SE of Desdemona, T. H. Dixon Sur., Abst. 1,103. Drlg. 1,875 ft.

J. Hickey et al No. 1 Smith, 5 mi. SE Desdemona, J. B. Smith Sur. Drlg. 2,900 ft.

Hoffman & Page No. 1 Clayton, D. J. O. Millard Sur., 2 mi. SE Desdemona. Drlg. 2,950 ft.

Jones County

Butler & Horne No. 1 Mrs. R. Cox, 6 mi. E. Hamlin, sec. 3, G.H.&H. Sur. Drlg. 2,750 ft.

E. P. Campbell et al No. 1 L. H. Lee, 5 mi. S. Hawley, sec. 16, T.&P. Sur., Blk. 16. Drlg. 1,535 ft.

Fain, McGaha & Roberts No. 1 Daugherty, 2 mi. S Sandy Ridge pool, sec. 37, T.&P. Sur., Blk. 15. S.D. 1,943 ft.

Fain & McGaha Oil Corp. No. 1 Francis Olson, 3 mi. NE Avoca, sec. 190, B.B.B. &C. Sur. T.P. 3,213 ft.; S.D. 3,214 ft.; to set csg.

Felmont & Adams No. 1 Woodson, 1½ mi. SE Avoca, sec. 200, B.B.B.&C. Sur. Drlg. 2,075 ft.

Mack Hayes and Montour Oil Co. No. 1 Chittenden, 7 mi. SE Hamlin, Subd. 18, McMullen & McGloin Sur. 337. Drlg. 635 ft.

W. L. Herring et al No. 1 J. W. Grogan, ½ mi. SE Truly, Maria Rita Longario Sur. Drlg. 1,765 ft.

T. D. Humphrey No. 1 Fielder, 2½ mi. E Anson, sec. 34, O.A.L. Sur. Drlg. 423 ft.

Iron Mountain and Humble No. 2 Jones & Stasney, 3 mi. NE of Avoca, sec. 196, B.B.B.&C. Sur. Drlg. 225 ft.

Maro Oil Co. No. 1 Webb, sec. 2, C.&M. R.R. Sur., ¾ mi. NW Lueders. Drlg. 1,525 ft.

M. A. Mead No. 1 H. Osment. Drlg. 960 ft.

Oil States Expl. Co. No. 1 Olson, 4 mi. N Avoca, sec. 182, B.B.B.&C. Sur. Drlg. 1,715 ft.

Medders & Heydrick No. 1 Ann Shaheen, 2 mi. SW of Nugent, 220 ft. from S and E lines of most easterly SE cor. of sec. 50, T.&P. Sur., Blk. 15. Loc.

Owen M. Murray et al No. 1 Rial, 2 mi. E Avoca, sec. 198, B.B.B.&C. Sur. S.D. 1,750 ft.

Riddle et al No. 1 J. D. Freeman, 8 mi. SW Anson, sec. 6, T.&P. Sur., Blk. 17. T.D. 2,487 ft.; S.D. 2,487 ft.

Shaheen Oil Co. et al No. 1 Jenson, 2 mi. E of Avoca, sec. 198, B.B.B.&C. Sur. Drlg. 1,900 ft.

Dale Smith & Bert Fields No. 1 C. L. Carter, 3 mi. SW of Nugent, 220 ft. from N and W lines of SE¼ of SE¼ sec. 37, T.&P. Sur., Blk. 15. Loc.

Southern Oil Co. No. 1 B. W. Thane NE cor. County. Andrew Jones Sur. 114. Drlg. 3,250 ft.

Stanton & Miller No. 1 Gaither, 4½ mi. N of Anson, sec. 38, B.B.B.&C. Sur. Drlg. 1,750 ft.

Ungren & Frazier et al No. 1 Carl Eedahl, 3½ mi. NE Avoca, sec. 188, B.B.B.&C. Sur. Drlg. 2,865 ft.

Ungren & Frazier No. 1 Manley Heirs, SE cor. of county, 660 ft. from N and W lines of sec. 44, T.&P. Sur., Blk. 14. Spdg.

C. E. Waite, Trust, No. 1 Ray, 3½ mi. SE of Stamford, sec. 7, D.&D.A. Sur. Drlg. 2,160 ft.

Palo Pinto County

W. H. Clement No. 1 Federal Life Ins. Co., 2 mi. W Mineral Wells, sec. 51, T.&P. Sur., Blk. A (E of B). S.D. for pipe 400 ft.

Bill Cole et al No. 1 J. W. Harris Est., NW cor. county, De La Garza Sur. Drlg. 100 ft.

W. K. Gordon et al No. 1 Johnson, 5 mi. N Gordon, John Bird Sur. Drlg. 195 ft.

Henry Hobbs et al No. 1 Bessie Holt, 4 mi. S. Graford, sec. 1,783, T.E.&L. Sur. S.D. 200 ft.

King Oil Co. No. 1 S. F. Lee, 4 mi. NW Graford, 933 ft. from N and W lines of sec. 1,744, T.E.&L. Sur. M.I.M.

Ernest Lloyd et al No. 1 McClure, 3 mi. NE Graford, sec. 2,004, T.E.&L. Sur. S.D. 1,200 for csg.

Lone Star Gas Co. No. 1 Hart Oil Corp., CWL county, sec. 19n, T.&P. Sur., Blk. 3, 4,000-ft. test. S.D.O. 4,150 ft.

Shackelford County

J. F. Baker No. 1 Merrick Davis, NE cor. of S½ of county, 330 ft. from N and W lines of sec. 21, T.&P. Sur., Blk. 13. Loc.

Joe DeGrazier No. 1 Harbough, E cen. part of county, sec. 1,563, T.E.&L. Sur. 4,500-ft. test. Drlg. 250 ft.

Forest Dev. Co. No. 1 Hendrick, NW cor. county, sec. 12, A.B.&M. Sur., but in sec. 1, Blk. A, A.B.&M. Sur. Pits.

Forest Dev. Corp. No. 1 T. G. Hindrick, NW cor. of county, 2,600 ft. from N line and 4,300 ft. from W line of sec. 1, A.B.&M. Sur. Loc.

T. D. Humphrey No. 1 Alston, NE cor. county, sec. 16, H.&T.C. Sur., Blk. 3. Drlg. 1,060 ft.

C. J. Kleiner et al No. 1 Morris, 2 mi. NE Bluff Creek pool, sec. 187, E.T.R.R. Sur. Drlg. 1,420 ft.

Mesa Verde Oil Co. No. 1 Hennessey, 7 mi. E of SW cor. county, sec. 87, T.&P. Sur., Blk. 13. Drlg. 450 ft.

Owens-Snebold Oil Corp. No. 1 Haterius, sec. 163, B.B.B.&C. Sur. Drlg. 2,150 ft.

Stephens County

Barnett Pet. Corp. No. 1 J. Q. Corbett, 4 mi. SE Ivan, sec. 3, S.P.R.R. Sur., Blk. 3. Marble Falls 3,994-95 ft.; est. 10,000,000 ft. gas; T.D. 4,005 ft.; tstg. est. 75 bbls. oil per day.

W. B. Hamilton No. 1 B. O. Grant, CWL of county, sec. 63, B.A.L. Sur. 2,500-ft. test. S.D.

O. J. Perren No. 1 J. K. P. Hughes, NE cor. County of NW¼ sec. 6 A.B.&M. Sur., Abst. 2,683; P.B. to 3,970 ft.; drlg. by whipstock.

Stonewall County

General Crude Oil Co. No. 1 B. F. Harrison, NW cor. D. Harcrow Sur., 1½ mi. N of No. 1 Bryan. Drlg. 3,550 ft.

Tarrant County

E. E. Hoffpauir et al No. 2 W. H. Davis 2 mi. S Arlington, H. Blackwell Sur. S.D.O. 2,140 ft.

Taylor County

Bert Fields et al No. 1 Sears, sec. 223, Blk. 64, H.&T.C. Sur. Drlg. 750 ft.

Dale H. Dorn No. 1 Hopkins, 1 mi. NW View. Subd. 20, sec. 120, Guadalupe Co. Sch. Ld. Sur. Drlg. 3,075 ft.

A. Findley No. 1 Bowles Est., NE cor. county, sec. 26, B.A.L. Sur. Drlg. 1,955 ft.

Wise County

Latex Oil Co. No. 1 Smith, 3 mi. E of Bridgeport, Jas. Couch Sur. T.D. 4,075 ft.; C.O. bridge; testing.

Canadian Fields

(Continued from Page 263)

waiting for rotary equipment. Border Petroleums Syndicate is unloading equipment for a test on the Ralph Johnson farm at Barnwell.

The Red Beam Oil Co. is being organized by a group of Turner Valley drillers and field workers, to drill a cooperative test on acreage in the Taber field. About $10,000 cash is being put up, and 800 acres of leases pooled for the test, steel derrick being secured from Sunshine Oils test at Del Bonita and cable tool outfit from Spy Hill Royalties in Turner Valley. The test will spud some time in December.

In the Steveville district, Anaconda Oil Co. No. 1, LSD 15, section 9-22-12w4, is below 1,037 feet and preparing to run 13⅜-inch casing.

British Columbia Test

In the Sage Creek area, southeast British Columbia, Columbia Oils No. 1 is below 6,050 feet, and will if possible continue drilling through the winter.

Ontario Drilling

In the DeClute field, Kent County, Ontario, Union Gas Co. No. 34, S end Lot 138, North Talbot Road, Raleigh Township, finished at 1,550 feet. Drilled as an offset to Ajax Oil & Gas Co. No. 1, Pilon lease, in the same lot south of the road, which finished with 17,000,000 feet a day, Union No. 34 is a good gasser, though somewhat smaller than the Ajax well. In the same field, Union Gas Co. No. 35 Lot 142, South Talbot Road, is below 1,490 feet and drilling in. Gas Producers Syndicate of Detroit is below 600 feet on its No. 4 on the Pardo lease, in the same field. Location is on the southeast corner of the farm, 150 feet from Lake Erie and 250 feet from the east line. Stover & Rawlings, of Chatham, have the drilling contract.

In the Brownsville field, Oxford County, Treleaven & Patterson No. 2, Williams farm, Lot 26, Concession 12, Dereham Township, finished recently around 940 feet, showed an initial flow of 22,000,000 feet a day. Location was almost due west of the discovery wells, indicating a possible further extension of the producing area in that direction. Aloka Oil & Gas Co. No. 14, Lot 25, Concession 11, finished around the same depth with 2,100,000 feet a day.

Burke-Greis Oil Corporation

Producers of Petroleum

Cosden Bldg. Tulsa, Okla.

McCORD
TYPE "L"
Chemical Measuring
PUMP

6

The Standard of the
OIL FIELDS
McCORD RADIATOR &
MFG. CO. · DETROIT

NORTH TEXAS COMPLETIONS

Archer County

Bridwell Oil Co. No. 4 L. F. Wilson F, 1,380-89 feet, 15 bbls. L. T. Burns No. 3 J. L. Prideaux, 907 feet, dry and abandoned. Duncan & Marchman No. 10 N. I. Andrews, 973-85 feet, 15 bbls. Fain & McGaha Oil Corp. No. 6 fee, 1,808 feet, dry. Godding & Cochran No. 4 J. M. Kunkel, 1,144-64 feet, 15 bbls. Hammon-Hanlon-Buchanan, Inc. No. 1 W. P. Ferguson, 4,008 feet, dry. C. H. Herbig No. 1 H. O. Prideaux, 653 feet, dry. Schroeder and others No. 3 John Conner, abandoned location. Westmount Oil Co. No. 2 W. Shropshire, 1,105-1,811 feet, 12 bbls. Whitehill Oil Corp. No. 26 H. S. Whitehill, 680 feet, dry.

Clay County

F. M. Gates No. 2 I. H. Kempner, 1,004 feet, dry. Merrill and others No. 1 Taylor, 975 feet, dry. Texas Co. No. 1 O. T. Roach, 1,180 feet, dry.

Cooke County

Trumter Oil Co. No. 3 G. T. Andress and others, 745-63 feet, 39 bbls.; No. 4 G. T. Andress and others, 752-75 feet, 35 bbls.; No. 5 G. T. Andress and others, 762-86 feet, 180 bbls. Trumter Oil Co. and others No. 12 G. T. Andress and others, 781-822 feet, 40 bbls.

Montague County

Arco Oil Co. No. 14 Mrs. M. H. Salmon E, 1,593-1,611 feet, 115 bbls.

Wichita County

Boardman Brothers No. 6 J. L. Jackson, 697-99 feet, 10 bbls. Deep Oil Development Co. and Seaboard No. 2 Munger C, 3,697-3,786 feet, 650 bbls. Fresno Oil Co. No. 20 L. F. Ramming A, 1,679-1,734 feet, 50 bbls. King Oil Co. No. 1 T. L. Burnett and others C, 903 feet, dry; No. 1 E. A. Marten, 1,768 feet, dry. W. B. Omohundro and others No. 1 First National Co., 3,687-3,851 feet, 1,750 bbls. Ryan Consolidated Petroleum Corp. No. 120 G. L. Nance, 495-507 feet, 8 bbls.; No. 124 G. L. Nance, 570 feet, dry. Schwegeler & Persky No. 4 E. E. Goetze, 628-36 feet, 10 bbls. S. H. Walton No. 8 Will Burnett, 480-88 feet, 10 bbls.

Wilbarger County

Phillips Petroleum Co. No. 1 Waggoner "G Pratt," 2,571-73 feet, 650 bbls.

Young County

S. D. Glover No. 1 H. Hennig, 1,074-88 feet, 35 bbls. N. D. Goldsmith No. 8 J. P. Dunagan, 1,059 feet, dry. King Oil Co. No. 1 Texas L. & M. Co., 746-52 feet, 10 bbls. H. Lee No. 12 J. L. Boone, 543 feet, dry. Tide Water Associated Oil Co. No. 7 J. D. Carpenter A, 1,062-75 feet, 10 bbls. Hickok & Reynolds No. 1 J. J. Martin, 3,398-3,454 feet, 270 bbls. in three hours. Lupton & McLester No. 4 G. M. Gibson, 3,609-3,556 feet, 378 bbls.

CENTRAL TEXAS COMPLETIONS

Brown County

R. A. J. Cox No. 1 H. A. Nichols, 2,551 feet, dry and abandoned.

Callahan County

Ungren & Frazier No. 1 Mrs. M. Price, 1,292 feet, dry and abandoned.

Coleman County

Anzac Oil Corp. and others No. 2-J Morris, 2,345 feet, dry and abandoned. J. E. Ellis No. 1 Horseman, 1,245 feet, dry and abandoned.

Haskell County

E. W. Mariand and H. B. Drake No. 1 G. C. Carothers, 3,950 feet, dry and abandoned.

Jones County

Allred & Gray No. 2 N. C. Jackson, 1,976-2,001 feet, treated with 3,000 gallons acid, 395 bbls. Brown Eagle Oil Co. and S. B. Roberts No. 5 Guitar, 1,980-2,001 feet, treated with 2,000 gallons acid, 436 bbls. Condor Petroleum Corp. No. 14 Henry Sayles, 1,962-72 feet, 472 bbls. Lewis Production Co. No. 1 Wooters, 2,050 feet, dry and abandoned. Roeser & Pendleton No. 1 Rosenquist, 3,370 feet, dry and abandoned. Ungren & Frazier No. 2 S. A. Kelley, 2,105 feet, dry and abandoned.

Shackelford County

W. E. Butler No. 17 Morris, 1,585-1,605 feet, total depth, estimated 20 bbls., completed for key well. Roeser & Pendleton No. 43 Dawson & Conway, 1,593-1,606 feet, total depth 1,618 feet, 173 bbls.

Stephens County

Paul Garrett No. 1 Mabry heirs, 549 feet, junked hole.

Rules on Permit Extensions Are Announced by Ickes

Secretary of the Interior Ickes announces that oil and gas prospecting permits are eligible for extension to December 31, 1939, under the act of 1937 only if they are outstanding on December 31, 1937, and if they properly fall, on December 31, 1937, within one of the following classes:

(a) Permits committed in whole or in part to a cooperative or unit plan of development that on December 31, 1937, has been approved by the secretary, or is in process of revision;

(b) Permits which, together with other permits, have been committed in whole or in part to a cooperative or unit plan of development and operation for the whole of any single oil or gas pool or field (or reasonably compact area) filed before January 1, 1937, and rejected;

(c) Permits under which approved drilling was actively in progress within the year 1937;

(d) Permits under which at least one well shall have been drilled to not less than 2,000 feet subsequent to August 21, 1935;

(e) Permits issued subsequent to August 21, 1935, and for which timely compliance has been made with the drilling requirements of the act of 1920, to the extent required by December 31, 1937, or, in the absence of such timely drilling, for which an acceptable cooperative or unit plan of development and operation has been filed.

Permits outstanding on December 31, 1937, which do not fall within one or more of these classes will not be considered eligible for further extension. Permits whose initial two-year term expired prior to August 21, 1937, or whose extended term expired or will expire prior to December 31, 1937, are eligible for extension to December 31, 1937, if application for extension is filed before the final date of their current terms and if equities warranting extension exist in conformity with the existing departmental practice with respect to extensions. Permits issued subsequent to August 21, 1935, and whose initial two-year terms expire prior to December 31, 1937, are extended to that date by the act of 1937, to enable compliance with the conditions specified in clause (e).

The new legislation is applicable to nearly 8,000 permits issued on applications filed prior to August 21, 1935. The act of that date substituted a leasing system with a minimum royalty of 12½ per cent for the permit system and minimum royalty of 5 per cent provided for the leasing act of 1920. About 6,000 of these permits are past the two-year period of their initial term but have remained outstanding, some for 10 to 15 years, under extension provisions of various acts. The current term of the majority of these permits will expire December 31, 1937. From 1,500 to 2,000 of the outstanding permits affected by the new act are now in their initial term.

Sliverville Sand Is Streaky

BRADFORD, Pa., Nov. 8.—Healey Petroleum Co., drilling not far from the Niagara Oil Corp.'s Music Mountain gusher in the Bradford field, got a dry hole in the Sliverville sand, the source of the 1,200-bbl. per day production of the Niagara discovery well. It was the fourth test to the Sliverville sand. Two producing wells and two failures have been recorded. The Niagara Oil Corp. and the Minard Run Oil Co. were fortunate in hitting the big pay, but Minard Run Oil Co.'s first well and the Healey Petroleum Co.'s well were dry holes. The Minard Run company's dry hole was deepened to another formation and produces oil and gas, and the Healey Petroleum Co.'s well will be deepened to the Bradford sand at around 1,919 feet and if necessary to the Lewis Run sand at about 2,003 feet.

MARKET RECORD, ACTIVE OIL STOCKS

Compiled by Carl H. Pforzheimer & Co., 25 Broad Street, New York City, Member New York Stock Exchange and New York Curbe Exchange

New York Stock Exchange

1937 High	1937 Low	Week ending Nov. 6 Sales	Week ending Nov. 6 High	Week ending Nov. 6 Low	Week ending Nov. 6 Close	Stocks—	Total shares outstanding	Par value	Latest dividend	Payable or last paid	Dividends paid in 1936	1936 High	1936 Low	1935 High	1935 Low
114⅞	59	3,000	64½	60	60	Amerada Corp.	788,675	N.P.	50cQ	10-30-37	$2.00	125½	75	80	48½
37	18	5,700	24	22¼	22¾	Atlantic Refining	2,664,000	$25	25cQ	12-15-37	1.25	35⅛	26⅝	28	20½
43⅜	10⅛	7,900	18½	15¾	16¼	Barber Co.	387,149	$10	75c	12-16-37	.50	38½	21	22½	11¾
35¼	10	16,200	16½	14¼	14¼	Barnsdall Oil Co.	2,247,974	$5	25cQ	11-1-37	.80	28¼	14⅛	14¾	5⅞
20⅞	4⅝	30,500	9½	8⅛	8⅛	Columbia Gas & Elec.	11,610,036	N.P.	20c	5-15-37	.40	23⅜	14	15¾	3⅜
17⅞	7	38,600	11	9¾	9¾	Consolidated Oil Corp.	13,919,417	N.P.	20cQ	11-15-37	.80	17¼	11½	12¼	6½
49	24	18,800	35	30½	31	Continental Oil of Delaware	4,682,615	$5	50cQ†	9-30-37	1.50	44⅞	28⅛	35	15⅛
17⅝	4¾	12,900	8¾	7½	7½	Houston Oil (new)	1,098,618	$25	....	10-17-30	....	13⅞	6⅜	7	1½
35⅜	14	6,600	22¾	20	20½	Mid-Continent Petroleum	1,855,912	$10	$1	21-1-37	1.15	30⅞	17¼	20½	9½
34	16⅛	800	19⅞	18	18	Mission Corporation	1,399,345	N.P.	$1	6-15-37	.45	29⅞	16¾	17¾	10⅜
26	21⅛	11,700	25	21⅛	22¼	National Supply	382,591	$25	....	5-15-31	....	75½	19⅞	20⅞	9
22⅞	9	23,900	14	12⅛	12¾	Ohio Oil Co.	6,563,377	N.P.	50cSA	6-15-37	.60	18	12⅛	14¼	9¼
29¾	12⅛	3,300	16	13	14	Pacific Western Oil	1,000,000	N.P.	65c	12-18-36	.65	23½	11¾	14	6¾
4½	1	1,400	1¾	1½	1¼	Panhandle P. & R.	198,770	N.P.	....	....	....	4¼	1⅜	1⅞	½
64	30⅛	19,500	46	41⅝	41⅝	Phillips Petroleum	4,449,052	N.P.	75cQ†	12-1-37	2.50	52⅜	38⅛	40	13¾
29⅞	13	7,400	19½	16¾	17¼	Plymouth Oil Co.	1,050,000	$5	35cQ	9-30-37	.90	27¾	11⅞	13	6½
24⅜	8¾	43,500	14¼	12¼	12½	Pure Oil Co.	3,281,120	N.P.	....	9-1-30	....	24⅞	16	17	5⅞
54⅛	16	3,300	25	20½	21½	Seaboard Oil of Delaware	1,224,283	N.P.	25cQ	9-15-37	1.00	44	30½	36⅞	20¾
34¾	15½	4,700	19¼	17⅝	17⅝	Shell Union Oil	13,070,625	N.P.	50c	7-15-37	.25	28¼	14¾	16½	5½
105⅜	95	800	97	95	95	Shell Union Oil 5½% pfd.	343,500	$100	$1.37½Q	10-1-37	28.87½	127½	102	111	63⅛
4¼	2½	800	2⅞	2½	2⅝	Simms Petroleum	461,698	$10	75c liq.	11-3-37	2.25 liq.	6¾	3½	18¾	4¾
60⅝	28¼	2,900	37½	32⅝	33⅛	Skelly Oil	1,006,348	$15	50c	9-30-37	....	47⅜	19½	20½	6½
23¼	13	73,800	17¼	15⅜	15⅝	Socony-Vacuum	31,151,071	$15	25cSA	9-15-37	.70	17½	12½	15¾	10⅝
50	28	24,100	33¾	30⅞	32¼	Standard Oil of California	13,014,754	N.P.	45cQ†	9-15-37	1.20	47⅝	35	41⅛	27¾
50	26½	16,100	36⅜	33⅞	33⅞	Standard Oil (Indiana)	15,196,241	$25	$1Q†	12-15-37	2.40	48½	32¾	33⅜	23
36½	30⅝	200	34¼	32½	32½	Standard Oil of Kansas	134,841	$10	$1	12-26-36	1.00	31	25	32	20
76	42½	35,100	53¼	49⅜	49¾	Standard Oil of New Jersey	25,856,081	$25	$1.25SA†	12-15-37	2.00	70⅜	51⅛	52⅜	35¾
77½	54	1,900	56	54	54½	Sun Oil	2,156,825	N.P.	25cQ	9-15-37	$1 & 6% Stk.	91	70	77	60½
65⅛	34¾	37,900	45½	40	40¼	Texas Corp.	10,896,858	$25	50cQ	10-1-37	1.50	55¼	28⅞	30¼	16½
9⅝	2	13,100	4⅜	3¾	4⅛	Texas Gulf Producing Co.	888,132	N.P.	5c	12-15-36	.05	8⅞	4⅜	4¾	2½
16⅝	5¾	8,000	9½	8⅛	8⅛	Texas Pacific Coal & Oil	888,237	$10	10c	12-1-37	.25	15¼	7½	9¼	3¼
21⅝	13⅛	11,800	16	14⅜	15	Tide Water Associated	6,288,512	N.P.	35cQ†	9-1-37	.70	21¾	14¾	15⅞	7⅝
28¼	17½	15,700	21½	19½	19½	Union Oil of California	4,386,070	$25	55cQ†	11-10-37	1.00	28½	20¾	24	14¾
31½	22½	1,800	24	22½	22½	Union Tank Car Co.	1,200,000	N.P.	40cQ	9-1-37	1.20	31⅝	22⅝	26½	20⅞
6¼	1¾	700	2¾	2½	2½	Wilcox Oil & Gas	424,839	$5	....	5-10-28	....	5¼	2¾	3⅛	1

*Ex-dividend. †Includes extras.

New York Curb Exchange

1937 High	1937 Low	Week ending Nov. 6 Sales	Week ending Nov. 6 High	Week ending Nov. 6 Low	Week ending Nov. 6 Close	Stocks—	Total shares outstanding	Par value	Latest dividend	Payable or last paid	Dividends paid in 1936	1936 High	1936 Low	1935 High	1935 Low
21⅜	7	2,500	11⅜	10⅞	11¼	Bridgeport Machine Co.	260,000	N.P.	25c	9-30-37	$1.00	21	13¼	14⅛	3¾
51½	42	250	44	42	42	Buckeye Pipe Line Co.	200,000	$50	75cQ	12-15-37	3.25	50	39¾	42½	30½
2¾	¾	6,100	1⅛	1	1	Carib Syndicate	799,020	25c	....	....	....	4⅞	1⅞	4¼	1⅝
123	95½	50	98	98	98	Chesebrough Mfg. Co.	120,000	$25	$1.50Q†	9-30-37	7.00	124¾	105	157	115
5⅜	1½	70,900	2¼	1⅞	1⅞	Cities Service	37,804,394	N.P.	....	6-1-32	....	7⅜	3	3¼	¾
5½	1½	2,700	3	2¼	2¼	Cosden Petroleum	399,687	$1	....	....	....	4½	1½	1½	¼
38¾	20¼	4,900	25¾	23½	24	Creole Petroleum	6,974,356	$5	50cSA†	6-10-37	.50	39	19⅞	23¾	10
18⅝	6½	300	8⅛	8	8	Darby Petroleum	351,390	$5	25cSA	1-15-38	.50	18⅛	9	8⅞	4
8⅜	2¼	2,600	5	4¼	4½	Derby Oil & Refining	263,162	N.P.	....	....	....	6¾	1⅞	2	¾
47½	24½	No sales	..	..	..	Eureka Pipe Line	50,000	$50	$1Q	11-1-37	4.00	47½	38½	38	33¼
63½	33	8,400	43	40	40	Gulf Oil Corp.	9,076,202	$25	25cQ	10-1-37	1.50, 100% Stk.	59	36	74¾	50¼
87	55	8,900	63½	57½	57½	Humble Oil & Refining	8,923,935	N.P.	62½cQ	10-1-37	1.50	80	57	64	44
24¼	14½	7,600	18⅝	17¾	18	Imperial Oil of Canada	26,919,871	N.P.	62½cSA†‡	6-1-37	1.25	24½	19¾	22½	15⅝
15	5⅞	No sales	..	..	..	Indiana Pipe Line	300,000	$10	50cSA	11-15-37	.80	9¾	5½	6⅛	3⅝
39½	23½	5,300	31⅛	30⅛	30¾	International Petroleum	14,247,088	N.P.	$1.25†‡	6-1-37	2.50	39⅝	32⅝	39¾	28
15¼	7	5,100	8⅜	7⅝	7⅞	Louisiana Land & Exp.	3,000,000	N.P.	10cQ	9-15-37	.50	15⅜	9⅞	11⅜	4⅜
31	12½	2,600	21	18⅝	19	Lion Oil Refining	270,000	N.P.	25cQ	10-20-37	.75	17¾	7⅜	8⅛	3½
14¼	5¼	2,400	8¾	7⅞	8	Lone Star Gas	5,382,723	N.P.	20c	8-21-37	.60	14¼	9⅞	10⅞	4½
14⅝	6¼	800	7⅞	7½	7¾	Midwest Oil Co.	998,444	$10	50c	12-15-37	....	....	....	....	....
7⅞	4⅛	800	5½	5	5¼	Mountain Producers	1,682,182	$10	30cSA	6-15-37	.60	8⅜	5	5¾	4⅛
19½	12	1,000	13⅝	13	13¼	National Fuel Gas	3,810,183	N.P.	25cQ	10-15-37	1.00	23	17⅜	20	11¾
12½	7¼	800	8½	8⅛	8½	National Transit	509,000	$12.50	45cSA	6-15-37	.75	15¾	9¼	10⅝	6¾
6⅛	4¼	No sales	..	..	..	New Bradford Oil	1,445,202	$5	18c	9-17-37	.10	4⅝	2⅞	3¼	2
5	1⅛	1,700	1¾	1½	1½	New Mexico and Arizona	1,000,000	$1	1c	12-1-36	.01	6⅝	1⅝	2½	1
5⅜	4	100	4½	4½	4½	New York Transit	100,000	$5	25cSA	10-15-37	.35	6¼	4¼	4⅞	3
12¾	5¾	No sales	..	..	..	Northern Pipe Line	120,000	$10	25cSA	12-1-37	.40	9¾	4⅞	8	5¼
9⅝	2¾	16,000	5¼	4½	4⅝	Pantepec Oil	1,608,700	N.P.	....	....	....	10⅛	3¼	4⅜	1¼
13¾	2	1,000	3⅞	3¼	3½	Root Petroleum Co.	336,045	$1	25c	2-1-37	.50	19¼	4½	5	1½
6½	2¼	400	3¼	3¼	3¼	Ryan Consolidated	296,931	N.P.	....	....	....	4¾	1⅞	2½	⅝
56	35	900	39	37¾	38	South Penn Oil	1,000,000	$25	$1.15Q†	9-30-37	2.60	44	32½	34½	21⅝
7¼	3⅞	No sales	..	..	..	Southern Pipe Line	100,000	$10	25cSA	9-1-37	.25	7⅞	3¼	5	3¾
42	40⅝	No sales	..	..	..	South West Penna. Pine Lines	35,000	$50	50cQ	10-1-37	13.00	60	44	56	44¼
21⅛	14¾	3,000	18½	17⅛	17⅛	Standard Oil of Kentucky	2,604,790	$10	40cQ†	9-15-37	1.35	23⅜	17⅛	24	18
11⅜	8	400	8¼	8¼	8¼	Standard Oil of Nebraska	188,403	$25	25c	3-29-37	.25	14⅝	11	12	7¾
45	16	700	25¾	22¼	22¼	Standard Oil of Ohio	753,740	$25	25cQ	9-15-37	2.00	40	21¾	23⅝	11½
4⅞	2	9,500	3⅜	2¾	2¾	Sunray Oil	1,910,119	$1	10c	12-24-37	.10	5	2⅝	2⅞	⅞
7⅝	2	300	4½	4½	4½	Texon Oil & Land	336,028	$2	15cQ	9-3-37	.60	9¾	5⅝	6⅞	5

*Ex-dividend. †Includes extras. ‡Payable in Canadian funds.
Note—In comparing highs and lows for the several years in the two tables, it will be necessary to take into consideration cases where there have been stock split-ups.

PERSONAL

C. C. A. BEELS has been made assistant to C. C. McKAY, head of the Carter Oil Company's land department, Tulsa, succeeding REX L. DAWSON, recently promoted to superintendent of the eastern division, with headquarters in Mattoon, Ill. For the past two years Mr. Beels was manager of the company's land office in Michigan.

DR. G. E. F. LUNDELL has been appointed chief of the chemistry division of the National Bureau of Standards, Washington, D. C., filling the vacancy created by the retirement of PERCY H. WALKER. He is succeeded as assistant chief of the division by DR. C. E. WATERS, formerly in charge of the section on organic chemistry. From 1910 to 1917 Doctor Lundell was assistant professor of analytical chemistry at Cornell University, from which institution he received his A. B. and Ph.D. degrees.

L. M. BARTON, vice president of Macmillan Petroleum Corporation of Los Angeles, is in London to investigate market conditions in Great Britain.

WATSON B. JOYES, president of the Ryan Consolidated Oil Corporation, Tulsa, left this week for a business trip to New York, accompanied by MRS. JOYES.

VIC BORSODI, independent operator of Houston, Tex., returned last week from a business trip to New York. He has been active in developing the Friendswood field of Harris County, and will resume activity in that field.

E. V. WHITWELL, chief geologist of the Carter Oil Company, spoke Thursday of last week before the Tulsa Geological Society on the Lower Marine formation play in North Louisiana, South Arkansas and extreme Northeast Texas.

EDWARD LUNDY and LYMAN R. LUNDY of Eldora, Iowa, and MARVIN H. HINSHAW and F. L. HINSHAW of Pierre, S. D., are the organizers of the Central South Dakota Oil & Gas Development Project, which has filed articles of incorporation to prospect for oil and gas in the central part of South Dakota.

JESS BULLARD, chief scout for the Shell Petroleum Corporation in the San Antonio, Tex., district for several years, is being transferred to Illinois, where he will take over his duties as chief scout for that area. He is being replaced in San Antonio by PAUL HINYARD, who comes from the Shell Corpus Christi offices. Mr. Hinyard will be replaced in Corpus Christi by J. M. ROBERTS, transferred from the Houston district.

DR. JAMES SHELBY THOMAS, president of the Chrysler Institute of Engineering, Detroit, Mich., chose "New Frontiers for Smart People" as the subject of his keynote address at the opening Thursday of this week of the thirty-eighth annual convention of the International Acetylene Association. The sessions are being held in the Tutwiler Hotel, Birmingham, Ala.

RUSH GREENSLADE, vice president of the Gulf Oil Corporation and head of the Gypsy division of that company in Tulsa, arrived in New York last week, with MRS. GREENSLADE, from a European tour. Mr. Greenslade planned to attend the A.P.I. convention in Chicago and then, accompanied by F. A. LEOVY, vice chairman of the Gulf board, to start on an inspection trip covering properties of the company in various parts of the United States.

H. H. KELLY, appointed purchasing agent of the Richfield Oil Company of California, Los Angeles, was born in England, majored in engineering at Armstrong College and during the World War was given a special assignment with the British Admiralty on marine construction. In 1920 he came to the United States and as soon as possible became an American citizen. He entered the oil industry in 1923, when he went to Los Angeles and began working on design, estimating and construction of refining units.

MISS GOLDIE C. VIELE has resigned as assistant secretary of the Natural Gas Department of the American Gas Association, in Dallas, Tex. Her successor is MISS GLADYS DAULTON, for the last three years with the Home Owners' Loan Corporation in Dallas. Miss Daulton was educated at the University of Tulsa and the University of Colorado. Miss Viele, whose resignation is effective November 15, will become secretary to CAPTAIN A. E. HIGGINS, vice president of the Pittsburgh Equitable Meter Company, Pittsburgh, Pa.

Do You Remember?

From The Oil and Gas Journal Files

25 YEARS AGO

Mrs. David Bovaird, 80, wife of one of the founders of Bovaird & Seyfang and Bovaird Supply Company, dies in Bradford, Pa.

Sarnia, Ontario, is the most important refining point in the Dominion of Canada. The Imperial Oil, Ltd., office building there houses 250 employes, and the Imperial's refinery employs 850 men.

J. W. (Wes) Sturm, prominent producer in Texas and Oklahoma, is found dead in his Elk Club apartment in Tulsa by his friend J. V. McMahon. Heart disease is given as the cause of his death.

20 YEARS AGO

Following the attempt to blow up the home of J. Edgar Pew in Tulsa which outrage was charged against I.W.W. members, a party of 40 armed Tulsa citizens held up 17 I.W.W. prisoners, who were in charge of the police, hustled them out into the Osage hills, where they flogged, tarred and feathered the luckless 17 and turned them out nearly naked in the cold November night. Tulsa was never again bothered by the I.W.W.

Mrs. John H. Markham, Sr., wife of a widely known oil man and drilling contractor, dies in Bradford, Pa.

J. F. Darby, Muskogee oil producer, is elected president of the recently organized Mid-Continent Oil and Gas Association.

10 YEARS AGO

The most important problem confronting the refining industry is the manufacture of gasoline suitable as motor fuel for high-compression engines in automobiles, the next important development in the motor industry.

East Hackberry pool in Cameron Parish, Louisiana, is opened by a 1,000-barrel well of Calcasieu Oil Company.

The Amarillo to Denver natural gas line is assured. It involves 350 miles of 22-inch line pipe, about 100,000 tons. Contracts are being let.

R. H. HARGROVES, Houston, Tex., vice president of the United Gas Public Service Corporation, and MRS. HARGROVES are on a two weeks' motor trip through the South and East.

ROBERT G. BOSSLER, production engineer of the Brundred Oil Corporation, Oil City, Pa., is visiting the company's properties in the Mid-Continent fields.

C. W. SANDERS, regional geologist, is returning to the Shell Petroleum Corporation's office in Houston, Tex., this week after spending a year in Europe with the Shell organization and 10 months in California with the Shell Oil Company.

C. P. BOWIE, supervising engineer of the San Francisco office of the oil and gas division, U. S. Bureau of Mines, has returned to his headquarters following a trip through the Mid-Continent and Gulf Coast fields, where the bureau is conducting studies in production problems.

T. H. WALLACE, petroleum engineer for the Gulf Oil Corporation, Houston, Tex., will leave soon for London, England, to supervise the drilling of a deep wildcat test near that city. He will be accompanied by three company drillers, A. O. BEAVERS, J. C. DUGAS and BUSTER BAEBEL, all of Houston.

D. G. SMITH, chief research chemist; R. STANSFIELD, chief research engineer, and DR. S. F. BIRCH, senior chemist of Anglo-Iranian Oil Company's London headquarters, are remaining in this country for the A.P.I. meeting in Chicago this week. The three engineers came to this country several weeks ago and among other meetings attended that of the S.A.E. in Tulsa.

PARAGRAPHS

STEEL WHITE, superintendent for the Sinclair-Wyoming Oil Company in Wyoming, has transferred his headquarters from the Wert field to the Sinclair offices in Casper.

ROY C. GRIFFIN, secretary of the Anadarko, Okla., Chamber of Commerce, was in charge of the first oil men's stag dinner and show held recently in the Anadarko fair park.

J. FRENCH ROBINSON, president of the Peoples Natural Gas Company, Pittsburgh, Pa., has been elected a director of the Union National Bank of that city. Mr. Robinson has been associated with the Peoples Natural Gas Company since 1921. He was elected vice president in 1933 and president in 1936. He is president and director of the Columbia Natural Gas Company, Lycoming United Gas Corporation, New York State Natural Gas Corporation and is an officer and director of numerous other companies, besides being active in the affairs of the Natural Gas Department of the American Gas Association.

ROBERT L. MINKLER, assistant to the president of the General Petroleum Corporation and president of the Los Angeles Petroleum Accountants Society, discussed tax problems confronting the petroleum industry at a recent meeting.

HALL WEEKS, Shell Petroleum Corporation, was chosen president of the Wichita Falls (Tex.) Geological Society to succeed VIRGIL PETTIGREW. TOM PETTY, Humble Oil & Refining Company, was elected vice president, and P. E. M. PURCELL secretary-treasurer.

PHILIP N. FAINE, New Straitsville, Ohio, secretary-treasurer of the Ohio Pennsylvania-Grade Oil Producers' Association, was elected a director of the Independent Producers' Association of America, to represent the state of Ohio, at the latter organization's annual meeting in Tulsa.

A. M. LLOYD, R. H. SMITH, V. P. GRAGE, R. T. HAZZARD and B. W. BLANPIED, Shreveport, La., geologists who attended the midyear meeting of the American Association of Petroleum Geologists in Pittsburgh, Pa., recently, made a series of talks on the convention at the last meeting of the Shreveport Geological Society.

A. C. STEWART, manager of service stations for the Union Oil Company of California, received at a recent meeting of the company's safety board in Los Angeles a bronze plaque awarded by the National Safety Council in recognition of the department's safety record for the first six months of 1937. The department had the lowest accident frequency among all major petroleum retail marketers in the United States. R. E. HAYLETT, director of manufacturing and chairman of the safety board, presented the plaque.

F. BANKS WARNER, general manager of the Cities Service Oil Company, Ltd., has returned to his London, England, office after being in the New York office of Cities Service interests since early September.

DR. GUSTAV EGLOFF, director of research for the Universal Oil Products Company, Chicago, has been appointed to head the Scientific and Technical Committee of the tenth International Petroleum Exposition in Tulsa next May.

WILLIAM J. KENNEY, chief of the oil and gas unit of the Securities and Exchange Commission, was guest speaker in New York November 5 at an open meeting of the Eastern States Association of Dealers in Oil and Gas Interests, Inc.

JOHN F. SINNOTT, New York district manager of the Bureau of Foreign and Domestic Commerce, and the personnel under him moved November 8 from the Customhouse to new and larger quarters in the Federal Office Building at Church and Vesey Streets. In the bureau's library are volumes of material pertaining to United States petroleum exports and oil operations in many foreign countries.

H. B. FUQUA, of the Gulf Oil Corporation, Fort Worth, Tex., president of the American Association of Petroleum Geologists, gave the opening address at the annual midyear meeting of the South Texas Geological Society in San Antonio, Tex., last week. Among the other speakers were DR. ROBERT H. CUYLER, University of Texas; O. R. CHAMPION, Amerada Petroleum Corporation; LEAVITT CORNING, independent geologist, and DR. DONALD C. BARTON, Humble Oil & Refining Company.

Says Everybody Kicked

Arnold J. Weideman, independent producer, recently made executive secretary of the Oil and Gas Association of Michigan, is a member of the state's house of representatives, having been elected from Isabella County last fall. He helped in the enactment of a gas conservation law and was primarily responsible for an adequate oil-country labor and lien law.

ARNOLD J. WEIDEMAN

In 1933, when the Porter pool threatened stabilization in Michigan, Mr. Weideman was appointed umpire, which post he held till the abandonment of proration. He insists he was a uniform success, because "everybody kicked." Brine disposal came next, and he was instrumental in working out the injection method now used.

Mr. Weideman, born in Sandusky, Ohio, in 1889, graduated from grade school into the factory through necessity. He continued study in night and correspondence schools, topping off with a night course at the San Francisco Law School. At 20 he got a job in the production division of the Standard Oil Company of California. From that point life was a series of ups and downs in oil fields of Ohio, Pennsylvania, Kentucky and eventually Michigan. During one of his "up" periods he built a home in Mount Pleasant, Mich., where he resides with his wife and three children and works over his shrubs, garden and lawn. Fishing is a hobby. All his friends call him "Whitey," and dignified newspaper reports use that nickname.

HERBERT A. GIDNEY, Pittsburgh, Pa., vice president and comptroller of the Gulf Oil Corporation, has been elected a vice president of the Controllers Institute of America.

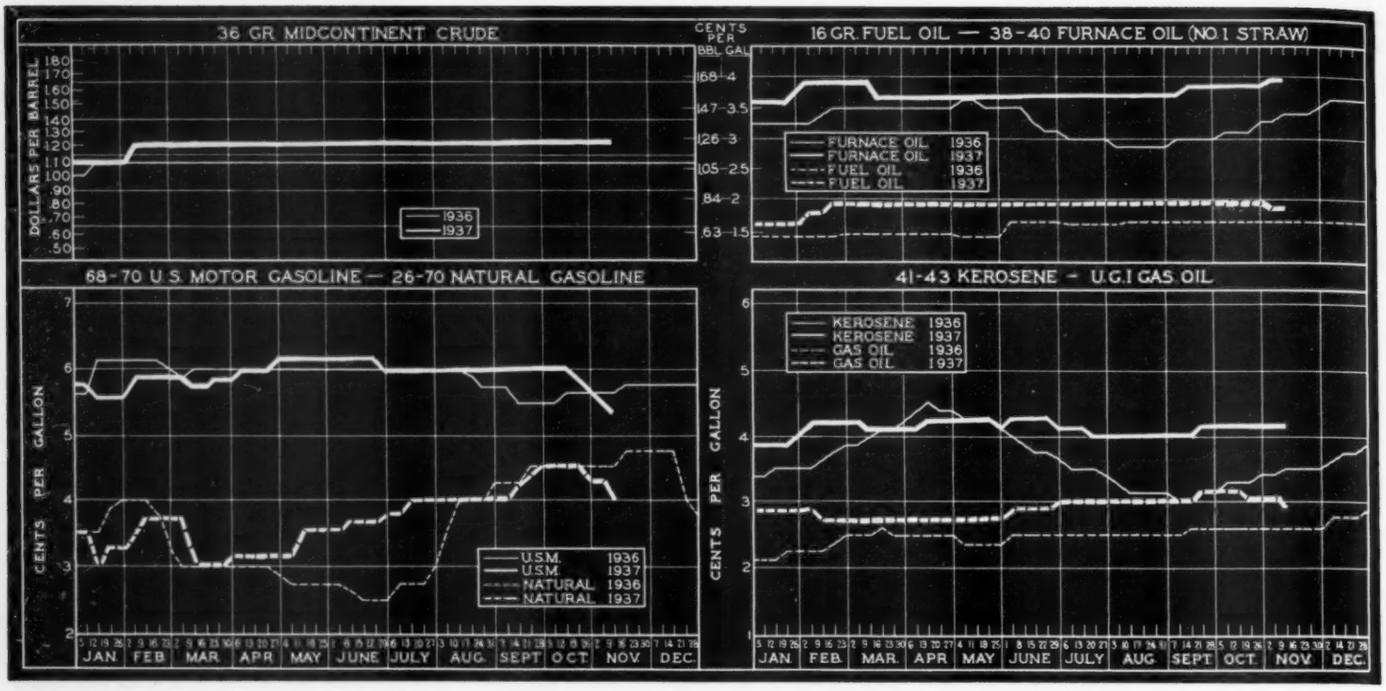
LOU STOGNER, independent operator of Dallas, Tex., has sold his interests in West Texas properties to Bond & Harrison, of that city and is moving to Fort Worth, Tex.

WARD DELANEY, industrial division vice president of the Shreveport, La., Chamber of Commerce, and L. MOSELEY MOFFITT, of the Triangle Drilling Company, Shreveport, have been elected to the board of directors of the Independent Petroleum Association of America.

F. S. SHEPARD, an executive in the Socony-Vacuum Oil Company, Inc., manufacturing department, New York, is on a business trip to various points in Texas, including Beaumont, where the Magnolia Petroleum Company, a subsidiary of the parent concern, operates a refinery.

HUGH MATIER, Los Angeles, a member of the Union Oil Company's public relations department and formerly a geologist for that company, addressed the Kiwanis Club of Bakersfield, Calif., last week and showed films of the Chinese war which had been sent to him by a friend in the Royal Irish Ulster Rifles.

JOHN W. BOATWRIGHT will be promoted from analyst to manager of the sales research department of the Standard Oil Company of Indiana November 15 to succeed JERVIS J. BABB, resigned. Mr. Boatwright joined Standard Oil September 6, 1932, after teaching economics at Northwestern University and serving as industrial examiner for the Federal Trade Commission.



Representative Mid-Continent Quotations on Crude Oil and Refined Products, Basis Oklahoma (Group 3)

Belief Group 3 Gasoline Prices Have Hit Bottom Is One Ray of Sunshine

By T. F. SMILEY

One ray of sunshine filtered through clouds overhanging the Group 3 gasoline market this week. It was the widely expressed belief that tankcar prices had touched bottom. Nobody could be sure, of course. The firm tone of the heating oils might have helped to dispel a little of the gloom, but their encouraging behavior was somewhat obscured by the fact that the naturals lost a quarter-cent in both Oklahoma and Texas Monday of this week. But, anyway, higher prices—not merely a halt in the dive they have been taking—are needed to bring a sick gasoline market back to health.

Prices Sink to New Lows

Tankcar prices on all grades of gasoline sank to new lows for the year. In fact, it is necessary to go back to early 1935 to find similar levels, and in that period crude costs and operating expenses were much less than they are now. Although refiners named 4¼ cents as fairly representing the low on sales of third-grade material, there were reports of odd cars of distress stocks picked up in North and Central Texas late last week at figures ranging as far down as 3⅞ cents.

More plant shutdowns were reported in the past week. Some refiners, declaring they were operating at a definite loss, were in a quandary. To keep on running meant further dipping into the red ink. To close down meant letting long-established business get away from them. In the East Texas area, where conditions have become particularly difficult, shutdowns have been noticeably numerous. More than a dozen plants there have been dismantled since the first of the year, and some of those still standing are understood to be scheduled for scrapping.

Refined Oil Market Barometer

An uneasy gasoline market seems to have derived not so much from the seasonal decline in consumption as from concern over the total quantity in storage, the fact that the rise in stocks began earlier than usual this fall and the general business nervousness. Heating oils and kerosene are in active demand. Heavy fuels and lubricants dull.

MID-CONTINENT. Gasoline and naturals off. Heating oils and kerosene firm.

EAST COAST. Gasoline weaker, owing in part to reduced tanker rates. Light fuels firm.

GULF COAST. Gasoline off. Burning oils firm.

CALIFORNIA. Market inactive but steady. Fuel oil and diesel firm.

PENNSYLVANIA. Gasoline and kerosene easier. Fuels scarce. Lubricants weak.

CHICAGO. Gasoline weak. Light-gravity burning oils firm. Heavy fuels soft.

The small refiner whose financial resources are limited and whose principal product is low-octane gasoline finds himself the chief sufferer from the dispirited state of the market, though the large integrated company has plenty of things to worry about. It was not uncommon in former years for the refining and marketing divisions of integrated companies to be operated at little or no profit in times of severe competition and yet for the company to present a fair earnings statement covering its total activities. Generous income from the producing and transportation divisions went far toward compensating for losses elsewhere and made possible a pretty satisfactory showing in aggregate revenues. But conditions have changed. Producing departments are yielding only reasonable returns on investment, and pipe line departments, once looked upon as a particularly fruitful source of income, are declared now to be in no shape to play Santa Claus.

Available information indicates that Mid-Continent refiners are planning substantial reductions in their runs to stills in the hope of relieving an overloaded market.

Naturals Down Too

Although natural gasoline was off, it was not slipping into the bog alongside the refinery product. Manufacturers said the price drop was not significant of any pronounced weakness in the market. Small plants had been accumulating stocks for which they evidently had no immediate outlet. Some of this surplus material was offered at concessions for quick movement. In addition to unwieldy stocks here and there, the declining quotations on refinery gasoline had their inevitable effect on the naturals. The increase in freight rates effective November 15 was responsible for a stream of rush orders last week, urging manufacturers to ship in time to escape the higher transportation costs.

Cooler weather in northern areas imparted additional life to the light-gravity heating oils. Prime white was especially tight and the No. 1 straw was becoming hard to find. Kerosene was in active demand. Low-gravity fuel remained dull, and the lubricant group lacked vigor.

Chief Activity in East Coast Market Centers on Domestic Heating Oils

By H. STANLEY NORMAN

NEW YORK, Nov. 9.—After last week's break in the gasoline and Bunker C fuel oil markets dealers took stock of their positions and spent much time attempting to predict future developments leading to dull trading. Chief activity during the week was centered on domestic heating oils, including kerosene, which appear to have escaped the bearish influence of the market in general.

Consensus of the industry charged the break in Bunker C fuel oil to the current low tanker rates applying to coastwise traffic. Considerable motor fuel has been turning in the North Atlantic market for several weeks at less than the quotations posted by major refiners, which is said to be the culmination of reduced tanker rates, excessive production and to the inclining stock curve which started up earlier this year than last. Motor fuel stocks continued to decline in 1936 through the end of October, reaching a low of 62,217,000 bbls. on October 31, according to Bureau of Mines statistics.

On the other hand, motor fuel stocks have been on a constant increase this year since the week ended October 2, according to the A.P.I. reports, climbing from 65,266,000 bbls. for the week ended October 2 to 66,836,000 bbls. on October 30, a gain in the four weeks of 1,570,000 bbls. While the gain in itself is insignificant in relation to consumption, the trend of additions to stocks a full month earlier than occurred in 1936 is considered important by observers.

In addition to the trend in motor fuel stocks, a factor of market importance is the continued low rate for tankers available for coastwise trade and the prospect that the charter quotations will cling near the present level. With several new tankers launched since the charter market hit its peak of 55 to 60 cents per barrel for coastwise trips early last summer and several more on the ways nearing completion, it appears to observers as improbable that any increase will take place in the near future.

Importance of the tanker rate so far as North Atlantic marketing conditions are concerned may be confirmed to some extent by an examination of the gasoline stocks on the Gulf Coast, including both Louisiana and Texas, and those on the East Coast, as compiled by the American Petroleum Institute. Since September 25, gasoline stocks on the Gulf Coast increased about 507,000 bbls. to October 30, or from 9,452,000 to 9,957,000. There was an even higher Gulf Coast stock total reached on October 23 of 10,301,000 bbls., but it dropped back to 9,957,000 bbls. on October 30. On the East Coast, stocks came down 410,000 bbls. from a total of 18,630,000 bbls. on land September 25 to 18,220,000 bbls. on October 30. East Coast stocks reached their low for the period under consideration on October 23 of 18,127,000 bbls., the same week in which Gulf Coast stocks were at their highest level.

While it is normal to expect a tapering off in gasoline movement from the Gulf Coast to North Atlantic points at this season of the year in conformity with slackened early winter demand, the position of stocks on the south coast is even more important this year in market conditions since the tanker rate remains low.

Usually the demand for fuel oil movement north not only absorbs the slack from curtailed gasoline traffic from summer peaks, but frequently in the past has turned tanker rates upward for duration of the winter. There is no change in expectations of an all-time record breaking demand for fuel oil this winter, but the increased tanker capacity added during the past few months and more coming probably will produce a dull charter market for an indefinite time. Heating requirements in the North, governed by temperature ranges this winter, may alter the current tanker rate outlook, but in most instances companies have augmented their tanker fleets over the past few months with an eye to requirements for some time in the future. In addition to the more direct influences on the East Coast market such as the tanker rate and the Gulf Coast stock position, the inevitable overlap of territories played its part in cracking the gasoline market in this territory. This is particularly sensitive through states bordering on the Great Lakes as well as along the Gulf of Mexico and Atlantic Coast lines.

Socony-Vacuum Oil Co., Inc., lowered tankcar quotations and dealer tank-wagon prices a half cent per gallon in most parts of New York and in the New England states. Exceptions included the points at which quotations had been subnormal in eastern Massachusetts around Boston and Springfield; Bangor, Waterville and Lewiston, Me.; Bridgeport, Conn.; Syracuse, Buffalo and New York City. Competing refiners adjusted their postings at the points involved.

In New York and immediate vicinity there was little change in the motor fuel market. Rumors persisted that 65-octane gasoline is available at 7¼ to 7⅛ cents per gallon in tankcars, but the large suppliers still quoted 7½ cents in tankcars and 7¼ cents in barges for New Jersey shipment. Movement of gasoline both to tankcar and barge customers in New York harbor territory was reported "fair."

Statistics conveying the extent to which gasoline consumption increased in this territory during the late summer were made available last week in Albany. Mark Graves, New York state tax commissioner, reported September receipts of $6,584,268.95 in gasoline taxes for August sales. August receipts based on July sales were $6,993,255.41. This year's July sales were 2,418,465 gallons greater in New York than in 1936 and the August consumption was reported up 3,243,838 gallons from last year's business as reported to the tax commissioner's office.

The motor fuel reduction along the North Atlantic Coast was extended to the middle Atlantic territory where 65-octane gasoline was quoted at 7½ cents per gallon at Charleston, Norfolk and Wilmington. Atlantic Refining Co. cut tank-wagon and commercial tankcar gasoline prices a cent per gallon in part of its territory. The tankcar price in eight counties was lowered to 7½ cents per gallon and split dealer tank-wagon customers were quoted 8½ cents for "house brand" motor fuel. Standard Oil Co. of Kentucky reduced its gasoline prices a half cent per gallon throughout its territory taking care of the lower part of the middle Atlantic district. Standard Oil Co. of Ohio adjusted prices a quarter of a cent per gallon in two states and placed tank-car kerosene business in 10 northern Ohio counties on a competitive basis with Michigan suppliers rather than adhering to Pennsylvania quotations. Kerosene was in reasonably strong position in New York harbor territory, but some suppliers were dealing on a basis of 6¼ cents per

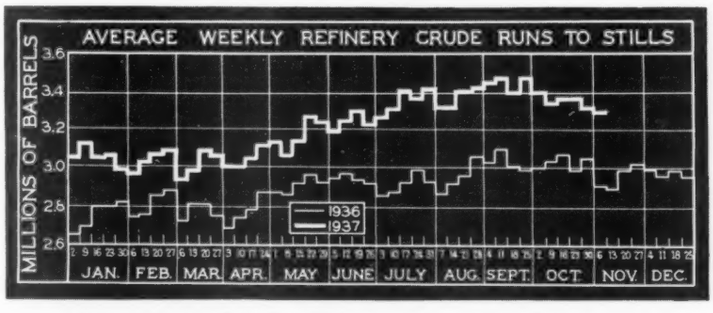
(Continued on Page 282)

A. P. I. Weekly Refinery Statistics

Week Ending November 6, 1937

	Capacity reporting (per cent)	Daily crude runs (bbls.)	Total gasoline stocks	Gas oil and fuel oil stocks
East Coast	100.0	533,000	18,260,000	15,145,000
Appalachian	88.4	102,000	2,616,000	956,000
Indiana, Illinois, Kentucky	92.4	461,000	10,009,000	7,488,000
Oklahoma, Kansas, Missouri	84.7	265,000	6,146,000	3,952,000
Inland Texas	56.6	122,000	1,947,000	1,900,000
Texas Gulf	95.7	734,000	8,282,000	11,347,000
Louisiana Gulf	96.6	154,000	2,062,000	3,644,000
North Louisiana and Arkansas	63.7	50,000	406,000	469,000
Rocky Mountains	69.7	46,000	1,315,000	638,000
California	90.9	538,000	12,588,000	72,136,000
Total reported	89.0	3,005,000	63,631,000	117,675,000
Estimated unreported	.....	320,000	3,640,000	3,250,000
*Estimated total	.....	3,325,000	67,271,000	120,925,000
*Estimated total previous week	.....	3,345,000	66,836,000	121,070,000
*November 7, 1936	.....	2,920,000	57,309,000	112,924,000

*Bureau of Mines, currently estimated.



Stocks of Crude Oil in the United States

(BUREAU OF MINES ESTIMATES)

October 23, 1937	306,556,000 barrels
October 16, 1937	307,897,000 barrels
October 24, 1936	289,737,000 barrels

RETAIL OIL MARKETS

Tank-wagon and filling station prices on gasoline and kerosene furnished by the larger marketing firms

Prices of of November 9, 1937

Taxes

The gasoline quotations given in the following tables include the 1-cent federal tax, as well as state, county and city taxes. The gasoline is the regular or standard grade. In most areas a third grade and a premium grade are also available.

Standard Oil Co. (Indiana)

	Gasoline			Kero.
	Tank wag.	Dlr.	Inc. tax	tank-wag.
Chicago, Ill.	15 2	13 2	4 0	10 1
Decatur	15 2	13 7	4 0	10 1
Joliet	15 2	13 7	4 0	10 1
Peoria	15 2	13.7	4 0	10 1
Quincy	15 0	13 5	4 0	9 9
Davenport, Ia.	15 2	13 7	4 0	‡13 1
Des Moines	15 0	13 5	4 0	‡12 9
Mason City	15 4	13 9	4 0	‡13 3
Sioux City	15 2	13 7	4 0	‡13 1
Duluth, Minn.	17 0	15 5	5 0	10 9
Mankato	16 6	15 1	5 0	10 5
Minneapolis	16 6	15 1	5 0	10 5
Lacrosse, Wis.	16 6	15 1	5 0	10 5
Green Bay	16 9	15 4	5 0	10 8
Milwaukee	16 5	15 0	5 0	10 4
Detroit, Mich.	15 1	13 6	4 0	9 8
Grand Rapids	16 2	14 7	4 0	10 9
Saginaw	16 0	14 5	4 0	8 5
Evansville, Ind.	16 7	15 2	5 0	†10 6
Indianapolis	16 9	15 4	5 0	†10 8
South Bend	17 1	15 6	5 0	†9 6
Fargo, N. Dak.	16 6	15 1	4 0	11 5
Minot	17 8	16 3	4 0	12 7
Huron, S. Dak.	17 0	15 5	5 0	10 9
Kans. City, Mo.*	14 6	13 1	4 0	8 0
St. Louis*	14 9	13 4	4 0	9 8
St. Joseph*	14 6	12 4	4 0	9 0
Wichita, Kans.	14 1	12 4	4 0	8 0

*State tax 2 cents, 1-cent city tax and 1-cent federal tax. †Does not include 4-cent state tax. ‡Iowa kerosene prices include 3-cent state tax.

(Exclusive of state general sales taxes, except Indiana and South Dakota.)

Discounts to commercial consumers: On purchases per month off tank-wagon prices: 1,000 gallons or more, 1.5 cents off; minimum delivery 25 gallons.

Stanolex Fuel Oil in Chicago

Effective Dec. 7, 1936, f.o.b. Chicago tank-wagon prices: Range oil, 1-99 gallons, 8.8 cents; 100-149 gallons, 7.8 cents; 150 gallons and over, 7.3 cents. Stanolex No. 1, 1-99 gallons, 8.8 cents; 100-149 gallons, 7.8 cents; 150 gallons and over, 7.0 cents. Stanolex furnace oil, 1-149 gallons, 7.8 cents; 150 gallons and over, 7.0 cents. Stanolex A, 1-399 gallons, 5.75 cents; 400 gallons and over, 4.75 cents. Stanolex B, 1-799 gallons, 5.75 cents; 800 gallons and over, 4.75 cents.

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline			Kero.
	Tank wag. dlr.	Tank car con'r.	Inc. tax	tank-wag.
Atl'tic City, N. J.	13 5	12 0	4 0	9 0
Newark	13 5	12 0	4 0	9 0
Annapolis, Md.	15 6	14 1	5 0	9 5
Baltimore	15 0	13 5	5 0	9 0
Cumberland	17 4	14 9	5.0	10.0
Wash'g'n, D. C.*	12 5	11 0	3 0	9 5
Danville, Va.	18 2	15 7	6 0	12 9
Norfolk	17 0	14 5	6 0	11 5
Petersburg	17 3	14 8	6 0	11 7
Richmond	17 3	14 8	6 0	11 7
Roanoke	18 5	16 0	6 0	12 9
Charles'n, W. V.	17 8	15 3	6 0	12 6
Parkersburg	17 1	14 6	6 0	11 2
Wheeling	17 0	15 5	6 0	12 2
Charlotte, N. C.	19 4	16 9	7 0	12 6
Hickory	19 9	17 4	7 0	13 0
Mt. Airy	19 7	17 2	7 0	12 8
Raleigh	19 0	16 5	7 0	12 1
Salisbury	19 5	17 0	7 0	12 7
Charleston, S. C.	18 0	15 5	7 0	11 1
Columbia	19 0	16 5	7 0	12 1
Spartanburg	19 7	17 2	7 0	12 9

*Standard of N. J. has discontinued posting service-station prices at all above points except at Washington and Baltimore where station prices of 16.0 and 18.5 cents, respectively, are in effect.

Price basis to commercial consumers, effective March 8, 1937, in Maryland, District of Columbia, and in Arlington and Fairfax counties in Virginia; and March 12 in New Jersey: To contract accounts purchasing at least one full compartment at time by hose connection, on yearly purchases: From 2,500 to 100,000 gallons, consumer tank-wagon price at time and place of delivery; 100,000 gallons per year, consumer tankcar price plus .5 cent per gallon. Consumer tank-wagon price generally will be equivalent to dealer tank-wagon price less .5-cent per gallon.

Effective May 15, 1937, in North and South Carolina, West Virginia and Virginia (except Arlington and Fairfax counties): Commercial consumers taking deliveries of 50 gallons (W. Va., 100 gallons) or more at one time will be billed at posted consumer tank-wagon price. Accounts taking deliveries of less than 50 gallons (W. Va., 100 gallons) will be billed at 4 cents per gallon over posted consumer tank-wagon price. Generally the posted consumer tank-wagon price will be equivalent to the dealer price less .5 cent per gallon.

Discount for kerosene, 1 cent off tank-wagon price for 25 gallons or more under contract (contract not necessary in Baltimore) except no discount in New Jersey

Southern District

STANDARD OIL CO. OF KENTUCKY

	Gasoline			Kero.
	Tank wag.	Net dlr.	Inc. tax	tank-wag.
Atlanta, Ga.	21 0	18 0	7 0	*†12 0
Augusta	21 0	18 0	7 0	*14 0
Macon	21 5	18 5	7 0	*14 5
Savannah	19 0	16 0	7 0	*12 0
Birm'ham, Ala.	20 0	17 0	8 0	12 0
Mobile	22 0	19 0	9 0	11 0
Montgomery	22 0	19 0	9 0	14 5
Jackson, Miss.	20 0	17 0	7 0	*13 0
Vicksburg	20 0	17 0	7 0	*13 0
Jacksonville, Fla.	20 0	17 0	8 0	†10 0
Miami	20 5	17 5	8 0	†12 5
Pensacola	22 0	19 0	9 0	12 0
Tampa	19 0	16 0	8 0	10 5
Lexington, Ky.	20 0	17 0	6 0	11 0
Covington	19 5	16 5	6 0	11 0
Louisville	20 0	17 0	6 0	10 5
Paducah	20 0	17 0	6 0	10 0

Price basis to tank-wagon consumers: Effective January 4, 1937, 3 cents per gallon below tank-wagon price. Kerosene prices in all states subject to 2 cents discount except in Kentucky where prices are net.

*Includes 1-cent state tax. †Subject to 2-cent discount.

Montgomery, Ala., has a county tax of 1 cent per gallon, and a city tax of 1 cent per gallon on gasoline, in addition to state tax; and 1 cent per gallon on kerosene Mobile, Ala., has a city gasoline tax of 2 cents per gallon; Birmingham, Ala., has a city gasoline tax of 1 cent per gallon; Pensacola has a city gasoline tax of 1 cent.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline		Kero.
	Dealer	Inc. tax	tank-wag.
Denver, Colo.	17.5	5.0	11.5
Grand Junction	20 0	5 0	15 0
Pueblo	16 0	5 0	10 5
Casper, Wyo.	18 0	5 0	11 5
Cheyenne	18 0	5 0	13 0
Butte, Mont.	19 5	6 0	15 5
Billings	21 0	6 0	15 5
Helena	21 5	6 0	15 5
Great Falls	21 5	6 0	15 5
Salt Lake, Utah	19 5	5 0	16 0
Twin Falls, Ida.	21 5	6 0	18 0
Boise	21 5	6 0	18 0
Albuquerque, N. M.	17 5	6 5	12 0

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline			Kero.
	Tank wag. con'r.	Di-vided dlr.	Inc. tax	tank-wag.
Ohio points	16 5	15.5	5.0	*13 5

*Includes state tax of 1 cent.

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA

	Gasoline			Kero.
	Tank wag.	Serv. sta.	Inc. tax	tank-wag.
San Francisco	17 5	18 5	4 0	11 5
Los Angeles	17 0	18 0	4 0	9 0
Fresno, Calif.	18 5	19 5	4 0	12 0
Phoenix, Ariz.	21 0	22 0	6 0	‡16 0
Reno, Nev.	20 0	21 0	5 0	13 0
Portland, Ore.	20 0	21 0	6 0	13 5
Seattle, Wash.	20 0	21 0	6 0	13 5
Spokane	23 0	24 0	6 0	16 5
Tacoma	20 0	21 0	6 0	13 5

‡Includes 5-cent state tax.

Discounts to dealers: On gasoline, off tank-wagon price, to 100 per cent dealers, 3 cents; to split dealers, 2 cents. To commercial consumers: on tank-wagon price: on single deliveries of 40 gallons and over, advance quantity discount extended at time of delivery, 3 cents. Service station schedule applies on single deliveries less than 40 gallons. On kerosene in tankcar, transport truck and trailer delivery, 3 cents off tank-wagon price; plant deliveries to jobbers, 2.5 cents below tank-wagon.

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline			Kero.
	Tank wag.	Dlr.	Inc. tax	tank-wag.
Omaha	17 6	16 7	6 0	10 4
McCook	18 0	14 0	6 0	10 9
Norfolk	18 0	16 5	6 0	10 8
North Platte	18 4	16 9	6 0	11.2
Scotts Bluff	19.1	15 9	6.0	11.9

Discounts to commercial consumers for tank-wagon deliveries covered only by standard commercial consumers contract, effective Jan. 1, 1935.

New York and New England

SOCONY-VACUUM OIL CO., INC.

	Gasoline			Kero.
	Tank wag. dlr.	Tank car con'r.	Inc. tax	tank-wag.
Albany, N. Y.	14 5	13 0	5.0	9.0
*Met. N. Y.:				
Manh't'n, Br'nx	14 0	13 0	5 0	9 0
Staten Island	14 5	13 0	5 0	9 0
Q'ns & Brklyn	14 0	13 0	5 0	9 0
Buffalo	15 05	14 04	5 0	8 5
Rochester	15 0	13 67	5 0	8 5
Syracuse	15 0	14 12	5 0	9 5
Boston, Mass.	11 75	13 0	4 0	8 5
Portland, Me.	13 0	14 8	5 0	8 75
Manch'ter, N. H.	15.8	13 5	5 0	9 5
Burlington, Vt.	15 4	13 4	5 0	9.5

*Does not include 2 per cent city sales tax which is calculated on basis of net retail price exclusive of state and federal taxes.

Price basis to undivided dealer: Posted dealer tank-wagon price less .5 cent. Price basis to commercial consumer: Effective Nov. 15, 1936, monthly purchases of 25,000 gallons and over, consumer tankcar prices at delivery point plus .5 cent per gallon; monthly purchases of 5,000 to 25,000 gallons, undivided dealer price at delivery point; monthly purchases under 5,000 gallons, pay divided dealer tank-wagon price at delivery point.

Oklahoma and Arkansas

CONTINENTAL OIL CO.

	Gasoline		Kero.
	Dealer	Inc. tax	tank-wag.
Muskogee, Okla	15 0	5 0	7 0
Oklahoma City	14 0	5 0	8 0
Tulsa	14 0	5 0	6 0
Ft. Smith, Ark.	15 5	5 0	8 0
Little Rock	18 0	7 5	9 5
Texarkana	15 5	5 0	8 5

Texas

	Gasoline			Kero.
	Tank wag.	Serv. sta.	Inc. tax	tank-wag.
Dallas, Tex.	14 0	18.5	5.0	8 0
Fort Worth	14 0	18 0	5 0	8 0
Houston	14 5	19 0	5 0	8 0
San Antonio	14 5	18 5	5 0	8 0

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline			Kero.
	Tank wag. dlr.	Tank car con'r.	Inc. tax	tank-wag.
N. Orleans, La.	20 5	18 0*	10 0	†13 0
Baton Rouge	18 5	16 0	8 0	12 0
Alexandria	19 0	16 5	8 0	12 0
Lafayette	19 5	17 0	8 0	13 0
Lake Charles	19 5	17 0	8 0	12 5
Shreveport	18 0	15 5	8 0	9 5
Knoxville, Tenn.	21 5	19 0	8 0	14 0
Memphis	19 5	17 0	8 0	12 0
Chattanooga	21 0	18 5	8 0	13 5
Nashville	20 5	18 0	8 0	11 5
Bristol	20.25	19 0	8 0	14.5

*Includes 2-cent parish tax. †Includes 1-cent parish tax and 1-cent state tax.

Standard of La. has transferred all stations to dealers except in New Orleans and Baton Rouge where station prices are 24 and 22 cents per gallon, respectively.

Price basis to commercial consumers: Effective May 15, 1937, deliveries of 50 gallons or more in one delivery takes posted consumer tank-wagon price. Accounts taking deliveries of less than 50 gallons at one time pay posted consumer tank-wagon price plus 4 cents per gallon. Generally, the posted consumer tank-wagon price will be equivalent to the dealer price less .5 cent per gallon.

Louisiana kerosene prices include 1-cent state tax.

Pennsylvania, Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline			Kero.
	Tank wag. dlr.	Tank car con'r.	Inc. tax	tank-wag.
Philadelphia, Pa.	14 0	12 5	5 0	10 5
Pittsburgh	15 5	13 5	5 0	11 0
Allentown	15 0	13 5	5 0	11 0
Erie	14 5	13 0	5 0	10 0
Scranton	15 0	13 5	5 0	11 0
Altoona	15 5	13.5	5 0	11 0
Dover, Del.	14 5	....	5 0	11 0
Wilmington	13 5	....	5 0	11 0
Spring'd, Mass.	13 3	....	4 0	9 0
Worcester	14 3	....	4 0	9 0
Hartford, Conn.	14 1	....	4 0	9 0
New Haven	14 0	....	4 0	9 0
Providence, R. I.	14 0	....	4.0	8.5

Price basis to undivided dealers, dealer tank-wagon price less .5 cent per gallon. Price basis to commercial consumers in Pennsylvania and Delaware, effective March 11, 1937: Consumers under contract using 100,000 gallons or more per year full compartment hose deliveries, tankcar plus .5 cent. Consumers under contract using less than 100,000 gallons per year compartment hose deliveries, undivided dealer price. Consumers under contract less than full compartment delivery, consumers not under contract less than full compartment delivery, and consumers not under contract full compartment delivery, divided dealer price. Less than 25 gallons, tank-wagon delivery, 4 cents per gallon above undivided dealer price.

Naphtha

STANDARD OIL CO. (INDIANA)

	Tank-wagon*
Oleum spirits	15.7
V.M.&P. naphtha	16.0
Cleaners' naphtha	15.0
Stanisol	15.0

*Prices include 3-cent Illinois tax, but not 1-cent federal tax or 2 per cent retail occupational tax.

Prices f.o.b. Chicago. Each price subject to discount of 1 cent per gallon for 150 gallon lots if covered by contract.

Canada*

3 Star Imperial Gasoline
IMPERIAL OIL, LTD.

	Tank-wag.	Inc. tax	Kero. tank-wag.
Halifax, N.S.	24 0	8 0	18 5
St. John, N.B.	24 0	8 0	18 5
Montreal, Que.	21 0	6 0	17 5
Toronto, Ont.	22 0	6 0	17 0
Hamilton, Ont.	22 0	6 0	17 0
Winnipeg, Man.	27 5	7 0	20 7
Brandon, Man.	29 8	7 0	22 3
Regina, Sask.	29 5	7 0	22 0
Saskatoon, Sask.	32 3	7 0	24 8
Edmonton, Alta.	29 5	7 0	24 2
Calgary, Alta.	27 0	7 0	21 5
Vancouver, B.C.	23 0	7 0	23 0

*Imperial gallon used in Canada.

Divided dealers pay tank-wagon price. Discount to undivided dealers, 1 cent below tank-wagon price. In maritime provinces both divided and undivided dealers pay tank-wagon price.

Retail Price Changes

Standard Oil Co. (Indiana) November 2 reduced dealer gasoline .5 cent in Wichita November 3 reduced tank-wagon and dealer gasoline .3 cent at all points in the accompanying table except at St. Joseph the dealer price was unchanged and at Wichita where dealer gasoline was advanced .2 cent.

Standard Oil Co. of Ohio November 4 reduced tank-wagon and dealer gasoline .5 cent throughout Ohio.

Standard Oil Co. of Nebraska November 3 reduced tank-wagon and dealer gasoline .3 cent in Omaha, Norfolk and North Platte, and reduced tank-wagon gasoline .3 cent in Scotts Bluff.

Socony-Vacuum Oil Co., Inc., November 2 reduced tank-wagon and consumer tankcar .5 cent at all New York points except Syracuse and Buffalo, and at Portland, Manchester, and Burlington.

Kamsack Gas Strike

Near the Manitoba-Saskatchewan boundary, a test drilled 2½ miles southeast of Kamsack, Saskatchewan, by Coal Gate Oils, Ltd., of Regina, encountered gas in a stray sand at 233 feet. The test was being drilled with 15-inch hole, production being expected considerably deeper. There is a fair commercial production.

PRICES OF REFINED PRODUCTS

All quotations f.o.b. plant in cars for interstate or export movement except as otherwise noted

Prices of of November 9, 1937

The following quotations are exclusive of the federal excise taxes of 1 cent a gallon on gasoline and 4 cents on lubricating oils.

Refinery Gasoline

OKLAHOMA (Group 3)—

U. S. Motor grades:		
62 oct. and below (3d gr.)	.04¼	.04⅜
63-66 octane	.04⅜	.04¾
67-69 octane	.05	.05⅛
70-72 octane (regular)	.05⅜	.05½
60-62 400 grades:		
62 oct. and below (3d gr.)	.04¼	.04⅜
63-66 octane	.04⅜	.04¾
67-69 octane	.05	.05⅛
70-72 octane (regular)	.05⅜	.05½
64-66 375	.04⅞	.05
68-70 360	.05	.05⅛

NORTH TEXAS—

U. S. Motor grades:		
62 octane and below	.04¼	.04⅜
63-66 octane	.04⅜	.04¾
67-69 octane	.05	.05⅛
70-72 octane (regular)	.05⅜	.05½
60-62 400	.04¼	.04⅜
64-66 375	.04⅞	.05

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

U. S. Motor grades:		
62 octane and below	.04⅞	.05⅛
63-66 octane	.05⅛	.05¼
67-69 octane	.05½	.05⅝
70-72 octane (regular)	.05¾	.05⅞

ARKANSAS (Ark., N. La., Miss. del.)—

U. S. Motor grades:		
62 octane and below	.04⅞	.05⅛
63-66 octane	.05⅛	.05⅜
67-69 octane	.05½	.05⅞
70-72 octane (regular)	.05¾	.05⅞

CHICAGO (Based on Group 3)—

U. S. Motor grades:		
62 octane and below	.04¼	.04⅜
63-66 octane	.04⅝	.04¾
67-69 octane	.05	.05⅛
70-72 octane (regular)	.05⅜	.05½
60-62 400 grades:		
62 octane and below	.04¼	.04⅝
63-66 octane	.04⅝	.04¾
67-69 octane	.05	.05⅛
70-72 octane (regular)	.05⅜	.05½
64-66 375	.04⅞	.05⅛
68-70 360	.05	.05¼

PENNSYLVANIA (inland refineries)—

58-60 U. S. Motor:		
Below 60 octane	.05⅜	.05⅝
60-64.9 octane	.07⅛	.07⅜
65-70 octane	.07¼	.07½
64-66 390	.05¾	.05⅞
68-70 350	.05⅞	.06

CALIFORNIA (domestic movement)—

54-58 U. S. Motor	.07½	.08½
58-60 400, 65 oct. and higher	.08¼	.09¼

EAST COAST (Domestic)—

U. S. Motor below 60 octane:		
*New York (Bayonne)	.06¼	.06½
Baltimore	.06	.06¼
U. S. Motor, 60-64.9 octane:		
*New York (Bayonne)	.07¼	.07¾
Philadelphia	.07¼	.07½
Boston	.07¾	.08¼
Baltimore	.07¼	.07½
Charleston, S. C.	.07¾	.07¾
U. S. Motor, 65 and above:		
*New York (Bayonne)	.07½	.08
Philadelphia	.07¼	.07¾
Boston	.07¾	.08¼
Baltimore	.07½	.08
Charleston, S. C.	.07¾	.08¼

*All grades of gasoline one-eighth to one-fourth cent less for barge shipments. New York harbor prices are for New York and New England delivery. Prices for New Jersey delivery one-fourth cent lower.

GULF COAST (domestic)—

U. S. Motor grades:	
Below 60 octane	.05½
60-64.9	.05⅝
65 octane and higher	.05¾

Naphtha

PENNSYLVANIA (inland refineries)—

50-52 450 (blending)	.05⅜	.05½
52-54 450 (blending)	.05⅜	.05½
54-56 450 (blending)	.05½	.05⅝

Natural Gasoline

OKLAHOMA (Group 3)—

Grade 26-70		.04
Grade 18-55	.04¾	.04⅞

NORTH TEXAS—

Grade 26-70		.03⅞
Grade 18-55	.04⅝	.04¾

CALIFORNIA—

75-85 375-390	.06¾	.07½

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

Grade 26-70	.04⅝	.04¾

Tractor Fuel

OKLAHOMA (Group 3)—

40-42 gr., 315-325 l.b.p., 110 flash, 540-550 e.p.	.04⅛	.04¼
41-43 gr., 300-350 l.b.p., 110-125 flash, 500-520 e.p.	.04¼	.04½
46-48 gr., 210-230 l.b.p., 480 max., e.p.	.04¾	.04⅞

Kerosene

(All kerosene water white)

OKLAHOMA (Group 3)—

41-43	.04⅛	.04¼
42-44	.04¼	.04½

NORTH TEXAS—

41-43	.04⅛	.04¼

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

41-43		.04½

ARKANSAS (Ark., N. La., Miss. del.)—

41-43		.04½

PENNSYLVANIA (inland refineries)—

45	.05¾	.05½
46	.05½	.05⅝
47	.05⅝	.05¾

CHICAGO (Based on Group 3)—

41-43	.04	.04¼
42-44	.04¼	.04½

CALIFORNIA (Pac. Coast market)—

38-43 high burning test	.04¾	.06

NEW YORK (Bayonne, N. J.)—

41-43	.06 3/10

***GULF COAST (domestic)—**

41-43	.05¼

*Barge price one-eighth cent lower.

Furnace Oil

OKLAHOMA (Group 3)—

No. 1 prime white, 38-42	.04	.04⅛
No. 1 straw, 38-40		.03⅞
No. 2 straw, 32-36	.03⅝	.03⅞
No. 2 dark, 32-36	.03½	.03⅝
No. 3 zero to 15, 28-32	.03⅜	.03½
No. 3, 15 and above, 28-32	.02⅞	.03

NORTH TEXAS—

No. 1 prime white, 38-42	.04	.04⅛
No. 1 straw, 38-40	.03¾	.03⅞

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

No. 2, 32-36	.03½	.03⅝

ARKANSAS (Ark., N. La., Miss. del.)—

No. 2, 32-36		.03¾

CHICAGO (Based on Group 3)—

No. 1 prime white, 38-40	.04	.04⅛
No. 1 straw, 38-40	.03¾	.03⅞
No. 2 straw, 32-36	.03⅝	.03¾
No. 2 dark, 32-36	.03⅝	.03⅞
No. 3, zero to 15, 28-32	.03⅜	.03½
No. 3, 15 and above, 28-32	.02⅞	.03

NEW YORK (Bayonne, N. J.)—

*No. 1	.06 3/10
*No. 2	.05½
*No. 4	.05¼

*Barge deliveries one-eighth to one-fourth cent under above tankcar price.

Gas Oil and Fuel Oil

(Gas oil per gal.; fuel oil per bbl.)

OKLAHOMA (Group 3)—

U.G.I. gas oil	.02⅞	.03
No. 4, low cold test, 24-28	1.07½	1.12½
No. 4, 15 and above, 24-28	.90	.95
No. 5, low cold test, 18-22	.85	.90
Below 18 fuel oil, industrial	.75	.80

NORTH TEXAS—

U.G.I. gas oil	.03	.03⅛
No. 4, low cold test, 24-28	1.07½	1.12½
No. 5, low cold test, 18-22	.82½	.87½
Below 18 fuel oil, industrial	.75	.80

NORTH LOUISIANA (Ark., N. La. and Miss. delivery)—

10-14 fuel oil, industrial	.80	.85

CHICAGO (Based on Group 3)—

U.G.I. gas oil	.03	.03⅛
No. 4, low cold test, 24-28	1.07½	1.12½
No. 4, 15 and above, 24-28	.90	.95
No. 5, low cold test, 18-22	.85	.90
No. 5, 15 and above (18-22)	.80	.85
No. 6, low cold test, 10-16	.77½	.80

PENNSYLVANIA (inland refineries)—

36-40	.04¾	.05

CALIFORNIA—

Los Angeles:		
30-34 gas oil, per bbl.	1.40	1.50
24 plus diesel, per bbl.	1.35	1.45
24 plus diesel (bunkers)	1.60	1.65
12-16 (bunkers at tidewater)	1.05	1.10
10-16 (cargo lots)	.90	1.10
12-17 (tankcars)	.95	1.15
10-17 (high sulfur)	.65	.95
San Joaquin Valley:		
10-18 (tankcars)	.75	1.00
24 plus diesel, per bbl.	1.40	1.50
24 plus diesel (bunkers)	1.60	1.65
10-16 (bunkers)	1.10	1.15

GULF COAST—

28-30 gas oil	.04½	.04⅝
28-30 diesel (bunkers)		1.90
Bunkers (bulk cargoes)		.85
Bunker C (bunkers)		1.05

NEW YORK (Bayonne N. J.)—

27 plus, gas oil	.05	.05¼
28-30 diesel (lighterage 6¼c per bbl.)		2.20
28-30 diesel (tankcars)		.05¼
Bunker C (to ocean-going ships in N. Y. harbor)		1.25
Industrial fuel (tankcars)	.04½	.04¾

Lighterage charge 5c bbl. additional.

Bright and Steam Refined

OKLAHOMA (Group 3)—

Bright Stocks:		
190-200 D, 15-25		.20
150-160 D, 0-10		.17
150-160 D, 15-25		.16
150-160 E, 15-25		.15½
100-110 D, 0-10		.15½
Steam refined:		
631 green (treated)		.15½
600 dark green (untreated)		.05

PENNSYLVANIA—

Bright Stocks (Pennsylvania Grade No. 8 color, 140-150 at 210, 545-550 flash):

10 pour test	.19	.20
15 pour test	.18	.19
20 pour test	.17	.18
25 pour test	.16	.17
Steam refined:		
600	.09	.09¼
650	.12½	.13
600 Pennsylvania flash	.13	.13½
630 flash	.17	.17½
600 Warren E filtered	.14	.14½

Neutral Oil

(Vis. at 100° F. except Pennsylvania and color N.G.A.)

OKLAHOMA (Group 3)—

Zero to 10 Cold Test:		
150-3		.09
180-3		.10
180-4		.09½
200-3		.10½
200-4		.10
250-3		.11½
250-4		.11
280-3		.12½
280-4		.12
300-3½		.13
400-3½		.14
100-2½ paraffin oil 15-20 Cold Test:		.06
200-3		.10
200-4		.09½
250-3		.11
250-4		.10½
280-3		.12
280-4		.11½

GULF COAST—

Pale Oils:		
200-3	.07	.07¼
300-3	.07½	.07¾
500-3½	.08½	.08¾
750-3½	.08⅝	.09¼
1,200-3½	.09½	.09¾
1,500-4	.09¾	.10
Red Oils:		
200-5-6	.07¼	.07½
300-5-6	.07¾	.07½
500-5-6	.08	.08½
750	.08¾	.09
1,200-5-6	.09¼	.09½

CALIFORNIA (moving to dom. market)—

Pale Oils:		
100-2½-3	.07¼	.08
200-2½-3	.07¼	.08
300-2½-3	.07¼	.08
400-3-4	.07¼	.08
450-3-4	.07¼	.08
550-3-4	.09	.11
600-3-4	.09	.11
Red Oils:		
200-4-5	.07¼	.08
300-5-6	.07¼	.08
350-5-6	.09¼	.11½
400-5-6	.09¼	.11½
450-5-6	.09¼	.11½
500-5-6	.09¼	.11½
600-5-6½	.09¼	.11½
700-6½ plus	.09¼	.11½
750-6½ plus	.09¼	.11½
900-6½ plus	.09¼	.11½

PENNSYLVANIA—

150 vis. at 70° F. color, 400-405 flash:		
Zero pour test	.21	.21½
10 pour test	.20	.20½
15 pour test	.19½	.20
25 pour test	.18½	.19
180 vis. at 70° F., 3 color:		
25 pour test	.21	.21½
200 vis. at 70° F., 3 color:		
Zero pour test	.25	.25½
10 pour test	.24	.24½
15 pour test	.23½	.24
25 pour test	.22½	.23

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—

124-126 (a.m.p.) w.c. scale		.03

PENNSYLVANIA (inland refineries)—

122-124 (a.m.p.) w.c. scale	.0295	.0300
124-126 (a.m.p.) w.c. scale	.0295	.0300

NEW YORK—

Wax in bags fully refined:		
122-125 (a.m.p.) wax		.0445
125-127 (a.m.p.) wax		.0455
128-130 (a.m.p.) wax		.0480
130-132 (a.m.p.) wax		.0505
133-135 (a.m.p.) wax		.0535
135-137 (a.m.p.) wax		.0560
124-126 (a.m.p.) w.s.	.0295	.0300
124-126 (a.m.p.) y.s.	.0265	.0280
Petrolatum in barrels, carload lots:		
Dark green		.01⅞
Amber	.02⅞	.03
Extra amber	.03	.03⅛
Lily white	.06⅝	.06¾
Snow white	.07¾	.07⅞
Cream	.05⅝	.05¾

Export Prices

GASOLINE

GULF COAST—

U. S. Motor	.05⅞
60-62 400	.05½
61-63 390	.05⅝
64-66 375	.05¾

LOS ANGELES—

U. S. Motor grades:		
55-65 octane	.05¾	.06
65-69 octane		.06¼
Above 69 octane		.06½

KEROSENE

GULF COAST—

41-43 prime white	.05
41-43 water white	.05¼
44 water white	.05½

LOS ANGELES—

41-43 water white	.04½	.05

LUBRICANTS

(Pennsylvania Grade)

NEW YORK (f.o.s. in bbls.)—

Cylinder Stocks:		
600 Warren E	.21½	.22
600 S.R. unfiltered	.16½	.17
630 S.R. unfiltered	.21	.21½
600 flash, S.R.	.21½	.22
630 flash, S.R.	.25½	.26
Bright Stocks:		
8 color	.23½	.24
6½ plus color in dilution	.23	.23½

NEUTRAL OIL

200-3 color	.30	.30½
150-3 color	.25½	.26

PARAFFIN WAX

NEW YORK (prices per pound)—

123-126 a.m.p.		.04125
125-127 a.m.p.		.0425
128-130 a.m.p.		.0450
133-135 a.m.p.		.0525
135-137 a.m.p.		.0550
Crude Scale:		
124-126 w.s.	.0295	.0300
124-126 y.s.	.0265	.0280

CRUDE OIL PRICES

Oklahoma, Kansas, North Central and East Central Texas

(January 28, 1937)

East Texas (May 22, 1937)*	$1 35
Van, Tex.†	1.10
Camp Hill, Tex.	1 27
Cass County, Tex.‡	1.25
Talco	.73
Altus and Tipton, Okla.§	1 20
Other fields (see gravity table).	

*All companies. †Humble Oil & Refining Co.; Pure Oil Co. ‡Texas Co. §Gulf Oil Co. Talco by Humble Oil & Refining Co.

West Texas

See gravity table.

Pecos County*	.91
Pecos shallow†	.81

*Shell Petroleum Corp., Gulf Pipe Line Co., and Humble Oil & Refining Co. †Shell Petroleum Corp.

Rocky Mountain States

(Effective January 28, 1937)

Iles, Colo., light*	$1 18
Iles, Colo., heavy*	1 12
Greybull, Wyo.*	1 30
Torchlight, Wyo.*	1 30
Grass Creek, Wyo., light*†	1 30
Grass Creek, Wyo., heavy (Nov. 4, 1936)*†	.62
Hamilton Dome, Wyo. (Nov. 4, 1936)*	.57
Elk Basin, Wyo., light*†	1 30
Frannie, Wyo., heavy*	.62
Frannie, Wyo., light	.82
Hogback, N. Mex.*	1 33
Pondera, Mont. (Jan. 26, 1936)*	1 05
Salt Creek Dutton Creek and Midway, Wyo., take Stanolind's Oklahoma prices on a gravity basis.	
Big Muddy, Wyo.†	1 23
Rock Creek, Wyo.†	1 20½
Lea County, N. M. (see West Texas gravity table)	
Artesia, N. Mex.	.90
Maljamar, N. Mex.	.90
Canon City and Florence, Colo.	1 10
Florence, Colo.	.98
Lance Creek, Wyo.	.97
Sunburst, Mont. (Oct. 25, 1937)*	1 05
Cat Creek, Mont.	1 40
Cut Bank, Mont. (Nov. 1, 1937)	1 10

*Standard Oil & Gas Co. †Ohio Oil Co. ‡Continental Oil Co. Cut Bank by Toronto Pipe Line Co.

Middle Western States

OHIO OIL CO.
(Effective January 28, 1937)

Lima	$1 25
Illinois	1 35
Princeton, Ind.	1 35
Midland, Mich. (July 23, 1937)*	1 27
West Branch, Mich. (July 22, 1937)	1 09
Buckeye (July 23, 1937)	1.24½
Arenac, Mich (July 1, 1937)	1.21
Muskegon, Mich.	1.00
Eastern Kentucky:	
Big Sandy River	1 42
Kentucky River	1 50
Western Kentucky	1 40

*Posted by Pure Oil Co.
Midland, Mich., price posted by Simrall Corp. and Pure Oil Co. includes Greendale, Porter, Beaverton, Crystal and equal grades. West Branch and Arenac by Simrall Corp. Eastern Kentucky crude purchased by Ashland Refining Co., Ashland, Ky. Buckeye posted by Simrall Corp. and Pure Oil Co.

Gulf Coast

(January 28, 1937)

Choctaw and Darrow, La. See note below	
Clay Creek, Tex.	$1 00
Garden Island, La.	1 37
Cleveland, Tex.	1 27
Hardin, Tex.	1 15
Lafitte, La.	1 24
Livingston, Tex.	1 27
Welsh, La.	98
Tepetate (La.) (Jan. 4, 1937)	1 12

Duval, Jim Hogg, Webb and Zapata counties, Texas, and Heyser and Placedo fields take Mirando gravity prices. Jennings, La., 5 cents lower than Gulf Coast prices on each degree. Segno, Texas, takes Gulf Refining Co.'s Gulf Coast prices. Choctaw and Darrow, Louisiana, posted for first time by Standard Oil Co. of Louisiana, start below 21 degrees at 90 cents, with 3-cent differential up to 25 gravity, then 2-cent differential up to 40 and above, $1.36. Effective October 1, 1937, Stanolind Oil & Gas Co. in Evangeline, La., pays 92 cents for below 20 gravity, adding 2 cents for each degree upward to 40 and over, at $1.34.

Southwest Texas

(January 28, 1937)

Pettus	1.37
Salt Flat, Darst Creek, Hilbig, Carroll, Clark, Zoboroski	1.09
Luling	1.00
Lytton Springs	1.12

Saxet and Taft take same gravity table as Gulf Coast.

North Louisiana and Arkansas

Smackover, all grades	$ .90
Tullos and Urania	1 02
El Dorado East field	.90
Union County, Ark.	.90
Ouachita County, Ark.	.90

Eastern States

(Prices are 25 cents per bbl. below those posted on September 1)

TIDE WATER ASSOCIATED OIL CO.
(Effective October 12, 1937)

Bradford, Pa.	$2.35
Allegany, N. Y.	2.35

SOUTH PENN OIL CO.
(Effective October 12, 1937)

Pennsylvania Grade Oil in National Transit Lines (Bradford field)	2.35
Pennsylvania Grade Oil in Southwest Pennsylvania Lines	2.05
Pennsylvania Grade Oil in Eureka Pipe Line lines	2.00
Pennsylvania Grade Oil in Buckeye Pipe Line lines	1.85
Corning Grade Oil in Buckeye Pipe Line Co.'s lines	1.27

PENNZOIL CO.
(Effective October 12, 1937)

Pennsylvania Grade Oil in National Transit Lines:	
Group A	2.35
Includes Cochran, Franklin, Hamilton and Doolittle districts.	
Group B	2.34
Includes Tidioute district.	
Group C	2.30
Includes Turkey and Tidioute districts.	
Group D	2.29
Includes Bear Creek and Porkey districts.	
Group E	2.26
Includes Eldeneau, Bull Creek, Rough Run, Carbon, Dipner, Bredlin, McJunkin, Jameson, Kenerdell, Emlenton, Tiona, Lacey and Kinzua districts.	

PURE OIL CO.
(Effective October 12, 1937)

Cabin Creek, W. Va.	2.00
Bradford Hollow, W. Va.	2.00
Kelly Creek, W. Va.	2.00

Canada

Ontario (Sept. 9, 1933)*

Petrolia	$2.10
Oil Springs	2.17

TURNER VALLEY NAPHTHAS AND CRUDE OIL
(September 1, 1937, by Imperial Oil, Ltd.)

Clear naphtha and discolored naphtha, 65 gravity and higher	$2.36
Discolored naphtha and crude oil 40-40.9 gravity	1.36
Increasing 2 cents for each degree gravity with top price for 64-64.9 gravity	1.84

These prices f.o.b. producers field tankage.

*Imperial Oil, Ltd.

Mexico

Panuco*	$1.24

*In U. S. currency, f.o.b. ship, based on September spot market transactions.

Crude Prices by Gravities

	Oklahoma-Kansas	Oklahoma-Kansas	North and Central Texas	East Central Texas (Mexia district)	North Louisiana-Arkansas	Gray County, Texas	Hutchinson-Carson counties, Texas	Rodessa, Louisiana-Texas and Panola County, Texas	Conroe, Tomball, Raccoon Bend, (Deep) Satsuma	Gulf Coast	Gulf Coast	Lea County, N. Mex. West Texas except Pecos County	Mirando district, Texas	Marion County, Texas	Refugio, Greta, Saxet, Taft, Texas	Anahuac, Flour Bluff, Dickson, Turtle Bay	White Castle, Louisiana	Iowa, Louisiana	Cayuga, Texas
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Bel. 18	....	....	....	....	....	....	....	....	....	$ .90	....	....	....	....	....	....	....	$ .90	....
18-18.9	....	....	....	....	....	....	....	....	....	.92	....	....	....	....	....	....	....	.92	....
19-19.9	....	....	....	....	....	....	....	....	....	.94	....	....	....	....	....	....	$ .94	.94	....
20-20.9	....	....	....	....	....	....	....	....	....	.96	$ .95	....	$ .96	....	$1 01	....	.96	.96	....
21-21.9	....	....	....	....	....	....	....	....	....	.98	.98	....	.98	....	1 03	....	.98	.98	....
22-22.9	....	....	....	....	....	....	....	....	....	1 01	1 01	....	1.00	....	1 05	....	1 01	1 01	....
23-23.9	....	....	....	....	....	....	....	....	....	1 04	1 04	....	1.02	....	1 07	....	1 04	1 04	....
24-24.9	....	....	....	....	....	....	....	....	....	1.07	1 07	....	1.04	....	1.09	....	1 07	1 07	....
Bel. 25	....	$ 98	....	....	$ .90	....	....	$ .93	....	....	....	....	....	$ .90	....	....	....	....	$ .88
25-25.9	....	1 00	....	....	.92	....	....	.95	....	1.10	1 10	$ .78	1.06	.92	1.11	....	1.10	1 10	.90
26-26.9	....	1 02	....	....	.94	....	....	.97	....	1.13	1 13	.80	1.08	.94	1.13	....	1.13	1 13	.92
27-27.9	....	1 04	....	....	.96	....	....	.99	....	1.15	1.15	.82	1.10	.96	1.15	....	1.15	1.15	.94
28-28.9	....	1.06	....	....	.98	....	....	1.01	....	1.17	1.17	.84	1.12	.98	1.17	....	1.17	1 17	.96
Bel. 29	$1 06	....	$ .96	$1 03	....	....	....	....	$1 20	....	....	....	....	....	....	....	....	....	....
29-29.9	1 08	1 08	.98	1 05	1 00	....	....	1 03	1 22	1 19	1 19	.86	1.14	1 00	1 19	....	1.19	1 19	.98
30-30.9	1 10	1 10	1 00	1 07	1 02	....	....	1 05	1 24	1.21	1 21	.88	1.16	1 02	1 21	$1 16	1 21	1 21	1 00
31-31.9	1 12	1 12	1 02	1 09	1 04	....	....	1 07	1 26	1 23	1 23	.90	1 18	1 04	1 23	1.18	1 23	1 23	1 02
32-32.9	1 14	1 14	1 04	1.11	1 06	....	....	1 09	1 28	1 25	1 25	.92	1.20	1 06	1 25	1 20	1 25	1 25	1 04
33-33.9	1 16	1 16	1 06	1 13	1 08	....	....	1 11	1 30	1 27	1 27	.94	1 22	1 08	1 27	1 22	1 27	1 27	1 06
34-34.9	1 18	1 18	1 08	1 15	1 10	....	....	1 13	1 32	1 29	1 29	.96	1 24	1 10	1 29	1.24	1 29	1 29	1 08
Bel. 35	....	....	....	....	....	$ .96	$ .91	....	....	....	....	....	....	....	....	....	....	....	....
35-35.9	1 20	1 20	1 10	1 17	1 12	.98	.93	1 15	1 34	....	1 31	.98	1 26	1 12	1 31	1 26	1 29	1 29	....
36-36.9	1 22	1 22	1 12	1 19	1 14	1 00	.95	1 17	1 36	....	1 33	1 00	1 28	1 14	1 33	1 28	1 29	1 29	....
37-37.9	1 24	1 24	1 14	1 21	1 16	1 02	.97	1 19	1 38	....	1 35	1 02	1 30	1 16	1 35	1 30	1 29	1 29	....
38-38.9	1 26	1 26	1 16	1 23	1 18	1 04	.99	1 21	1 40	....	1 37	1 04	1 32	1 18	1 37	1 32	1 29	1 29	....
39-39.9	1 28	1 28	1 18	1 25	1 20	1 06	1 01	1 23	1 42	....	1 39	1 06	1 34	1 20	1 39	1 34	1 29	1 29	....
40.over	1 30	1 30	1 20	1 27	1 22	1 08	1 03	1 25	1 44	....	1 41	1 08	1 36	1 22	1 41	1 36	1 29	1 29	....

Column 1—Companies posting are Barnsdall, Bell, Champlin, Continental, Cushing, Derby, Bay, Eason, El Dorado, Cities Service, Falcon, Globe, Gulf, Johnson, Kanotex, National, Phillips, White Eagle, Stanolind, Sunray, Texas, Sun Vickers and Wilcox.
Column 2—Anderson & Prichard, Carter, Cosco, Deep Rock, Magnolia, Mid-Continent, Pure, Rock Island, Shell, Sinclair, Skelly and Tide Water.
Column 3—All purchasers.
Column 4—Humble Oil & Refining Co. and Sinclair Oil Purchasing Co.
Columns 5, 6, 7 and 8—All purchasers.
Column 9—Humble Oil & Refining Co. and Sun Oil Co. Tidewater Oil Co.'s schedule starts at 35 degrees, $1.34 with 2-cent spread up to 40 and over at $1.44. (Raccoon Bend prices are for deep sand oil.)
Column 10—The Texas Co. (Gulf Refining Co. pays same prices up to and including 34 gravity, but continues its 2-cent spread up to 40 and over at $1.41.)
Column 11—Humble Oil & Refining Co., Sinclair Prairie Oil Marketing Co., Sun Oil Co.
Column 12—All purchasers.
Column 13—All purchasers (effective July 6, 1937).
Column 14—Magnolia Petroleum Co.
Column 15—Humble Oil & Refining Co. (effective July 6, 1937).
Column 16—Humble Oil & Refining Co.
Columns 17 and 18—Shell Petroleum Corp.
Column 19—Tide Water Oil Co.

New York Market

(Continued from Page 279)

gallon rather than at 6.3 as had prevailed for some weeks. Barge deliveries of kerosene are being made at 6⅛ cents and occasional sales are said to be fractionally lower. The break of 10 cents per barrel in Bunker C fuel oil posted early last week by Standard Oil Co. of New Jersey making the price $1.25 per barrel at New York, Norfolk and Baltimore with $1.20 posted at Charleston followed an earlier indication that such a change was imminent. Before lowering the spot price, Standard of New Jersey announced that 1938 contract business with steamship lines would be accepted on a basis of $1.25 per barrel. Gulf Oil Corp., the Texas Co., Mexican Petroleum Co., Atlantic, Sun and other suppliers met the new quotations on or retroactive to November 1.

The light fuel oil market is holding firm in New York and other North Atlantic points. Tankcar deliveries of No. 2 fuel oil are holding at about 5¼ cents per gallon with occasional variations by fractions of a cent. The material is available in barges at 5⅛ cents per gallon, but in general the interest in No. 2 fuel oil is on the upgrade.

Considerable interest was shown in New York marketing quarters last week over the reported sale of 110,000 drums of aviation grade gasoline on the Gulf Coast for 8½ to 10 cents per barrel. Terms of the transaction call for delivery of 71-74 octane motor fuel for immediate loading. The cargo is reported intended for the Chinese government's air force.

Two cargoes of 64-66 375 e.p. gasoline for export shipment were sold during the past two weeks on the Gulf Coast for 6¼ cents per gallon. One cargo is to be loaded this month and the other is due for lifting in December. There are one or two other inquiries in the market for gas oil and gasoline but the business had not been placed at the end of the week. Gas oil is still tightly held on the Gulf Coast.

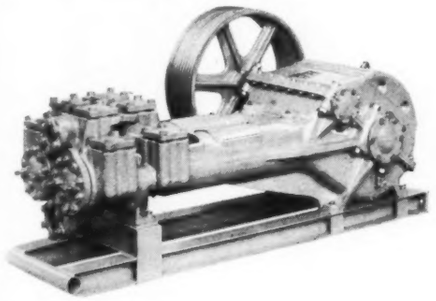
Ontario Wildcat

In Elgin County, Ontario, a test is being started by Oldreeve & McKechnie in Lot 12, Concession 10, Yarmouth Township, on the Miller farm. The location is a short distance north of St. Thomas, in an area previously untested, and south and west of the Brownsville field.

NEW OR IMPROVED EQUIPMENT

National Offers Duplex Power Pump for Oil-Field Work

The National Supply Co. has introduced a duplex power pump for general oil-field work, especially oil gathering, water and slush service. This pump, designated as the Ideal type D-50, has a maximum fluid cylinder bore of 5 inches with a stroke of 10 inches. The maximum working pressure of the fluid end is 1,000 pounds, and the maximum rated hydraulic horsepower is 50 at 60 r.p.m.



The frame is a two-piece high-test iron casting, heavily ribbed for strength and rigidity and split at the pinion-shaft and crankshaft bearings. This allows installations of the shafts with gears and bearings as complete units, adding to operating convenience. It also makes possible a narrower and stronger frame, since no extra width is required for assembly of parts within the case. Slush and other liquids are effectively excluded by a special baffle-wall assembly.

The gear and pinion are heat-treated Sykes herringbone generated by National. The pinion and pinion-shaft are forged integrally, and the shaft diameter is left unusually large to minimize deflection. The crankshaft is carried on two large Timken bearings and the pinion-shaft on two SKF self-aligning roller bearings.

The fluid end is a one-piece alloy iron casting, reinforced at point of greatest stress, with all sections made as nearly cylindrical and spherical as possible for maximum strength. Fluid cylinder liners are firmly supported in the cylinder and are packed against fluid leakage by a rubber ring behind the liner-collar. This packing can be tightened without removing the cylinder head. Alloy-steel intermediate rods make it unnecessary to open the crankcase when changing liners and pistons. Flood lubrication of a positive and automatic type is used on all working parts. The crank and pinion bearings are grease-packed through connections easily accessible from the outside of the case.

Bulletins, Booklets and Other Literature for the Trade

The Acme Fishing Tool Co., Parkersburg, W. Va., has issued an enlarged catalog, No. 12, containing the complete Drilmor line of drilling and fishing tools for oil and gas field operations. Additions to the company's line include recently perfected tools designed especially to meet the more exacting demands of high-speed, heavy-duty field operations.

The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc., Passaic, N. J., has issued an illustrated 4-page bulletin on Condor compensated belts. Engineering data essential to the proper selection, application and supervision of belts is included.

The new 1937-38 edition of the Johns-Manville industrial products catalog, a 64-page book, profusely illustrated, contains a wealth of information and recommendations on high- and low-temperature insulations for every industrial need.

Bulletin Y-4, "Tube Cleaners for Oil Refineries," offered by the Elliott Co., Jeannette, Pa., covers the Lagonda and Liberty line of equipment for removing carbon deposits from still-tubes and the various other tubes and pipes in the refinery.

A 24-page illustrated bulletin published by the Vanadium Corp. of America, New York, contains a description of the properties and applications of vanadium alloy steels for castings where high strength is required without excessive weight or high cost.

A bulletin from the Jeffrey Manufacturing Co., Columbus, Ohio, announces a new shale-shaker for conditioning rotary mud.

To Represent Manufacturers

Ray S. Riddle has become a partner of Max Landry, with headquarters at 533 Mayo Building, Tulsa, where they will represent, as a partnership, the following companies: Buffalo Gasolene Motor Co., Foote Bros. Gear & Machine Corp., Pennsylvania Transformer Co., Pyott Foundry & Machine Co., Terry Steam Turbine Co., Ideal Electric & Manufacturing Co., Simplex Corp. and United States Motors Corp. Both Mr. Riddle and Mr. Landry are graduate engineers and members of the Tulsa Engineers Club. Mr. Riddle graduated from Oklahoma A. & M. College in 1925, after which he took the Westinghouse apprenticeship course. He was with the Westinghouse Electric & Manufacturing Co. nine years. He went to Tulsa in 1929 and acted as sales representative for various manufacturers.

General American Expanding

A major expansion program at Corpus Christi, Tex., has been announced by the terminal division of the General American Transportation Corp. For the past year, General American's Corpus Christi terminal has been operating to capacity and unable to provide tankage facilities desired. Forty acres of additional property has been purchased, and work started on the erection of 600,000 bbls. of additional new tankage. Erection of a dock will be commenced soon. The terminal is one of five operated by General American. Others are at Houston, Tex.; Westwego and Goodhope, La., and Carteret, N. J.

In announcing the Corpus Christi expansion, Hugo Epstein, president and general manager of the terminal system, said: "There have been rumors that General American was going into the refinery business. This is incorrect. Neither the General American Transportation Corp. nor any of its divisions buys or sells oil, or has any financial or other interests in oil refining. Our operations with the oil industry are two only, as warehousemen and in furnishing tankcars."

B&R Drilling-Clamp Developed by Acme Is Light but Strong

The new B&R wire-line drilling-clamp developed by the Acme Fishing Tool Co., Parkersburg, W. Va., contains 10 parts and weighs 160 pounds. However, the light weight sacrifices no strength for the clamp has been tested to more than 200 tons breaking load, a safety factor of nearly 6 to 1 in comparison with the breaking strength of a 1-inch wire line.

One man can hitch on with ease. A safety grip is provided for handling while adjusting. The clamp is equipped with a patented nonfouling safety link, tested to a breaking load of 208,500 pounds. The design provides a safe place for the operator's hand as well as a convenient overhead location for attaching a jockey-stick, if desired.

With 12-inch liners this clamp is designed to carry a load of 15 tons. Pressure required to support such a load on a wire drilling line can be exerted by one man without use of a pipe or other device on the handle of the tee-screw. Although wells as deep as 8,000 feet have been drilled with the Acme clamp, it is recommended for depths not exceeding 4,000 feet. For depths below that there is the Acme 18-inch clamp, which is only 13 pounds heavier than the regular B&R clamp, but provides 50 per cent more gripping surface.

New Device Marks Advance in Depositing Molten Metal

Majestic MetaLayeR will deposit approximately 100 per cent more metal in a given time with approximately one-third less oxygen and acetylene consumption per weight of metal deposited in larger size wires, according to the Metals Coating Co. of America. The mechanical problem of feeding heavier wires, at greater speeds, required a new departure in the method of gearing and increased bearings throughout without the introduction of excessive weight or unwieldy size.

With the efficient design of turbine, a small increase only in the pressure and volume of compressed air is required over tools of lower capacity. The train of gearing from the turbine to the final feed-roll consists of two hardened worms, one bronze and one fibre gear, respectively, of special composition, and the entire gear assembly is enclosed in one compartment containing grease to insure perfect lubrication.

The feed-rolls are conveniently engaged by an adjustable latch bolt operated with a single motion, facilitating speedy engagement, sensitive control and quick release. The gun can be lit and flames adjusted with or without the wire feeding, thus eliminating the waste of wire during adjustment. No moving parts are exposed.

"Majestic" is well balanced and the final adjustment and control of oxygen, acetylene and compressed air are made with one movement of the valve handle. Oxygen, acetylene and air connections are readily replaced.

Bristol Introduces New Type of Potentiometer Pyrometer

The new potentiometer pyrometer shown in the illustration has been developed by the Bristol Co., Waterbury, Conn., for recording and indicating thermocouple temperatures. This indicating recording pyromaster provides for direct marking on a 12-inch round chart and scale indication on a large dial. It employs the potentiometer method of measuring electromotive force in terms of temperature, using standard thermocouples and extension leads, but it operates on a new and simplified principle. The instrument is rugged and not affected by excessive vibration. There is no mechanical motion except when a change in temperature occurs.

The operating mechanism is simple and compact, consisting of a highly dampened sensitive galvanometer, pivoted in jewel bearings; a special relay unit, actuated by the galvanometer to operate the motor which balances the electromotive force from the thermocouple and positions the recording pen-arm and scale-indicator; a standardizing unit; a "power pack" and the potentiometer or recording and indicating units.

The pen-arm or indicator is actuated through the relay switches in small steps, at a rate depending upon the rate of change in temperature at the thermocouple. No lubrication is required. The cold-junction compensator is fully automatic.

Bristol's pyromaster is available as a recorder, indicator, recorder with indicating scale, recorder controller, and as a recorder controller with indicating scale.

Here and There With Men Who Manufacture Equipment

The Terry Steam Turbine Co., Hartford, Conn., has appointed the following new representatives who will handle Terry turbines, reduction gears and turbo-generator units: C. F. Cate, Box 2037, El Paso, Tex.; the Darby Corp., Kansas City, Kans.; Ray F. Riddle, 533 Mayo Building, Tulsa.

Transfer of the International Harvester Co. Chicago offices from 606 South Michigan Avenue to a 23-story building at 180 North Michigan Avenue began after office hours Friday, October 8, and was completed at 1 p.m. the following Sunday. More than 300 van loads of furniture and equipment for an office personnel of approximately 1,000 were moved.

At its October meeting in Colorado Springs, Colo., the American Refractories Institute elected as its president Werner J. Westphalen, vice president and general manager of the Laclede-Christy Clay Products Co., St. Louis, Mo.

The Wilson & Bennett Manufacturing Co., maker of steel pails and drums, has appointed John T. Gossett eastern sales manager. His headquarters will be at the Jersey City office and plant and he will be in charge of all sales in the territory east of Pittsburgh, Pa.

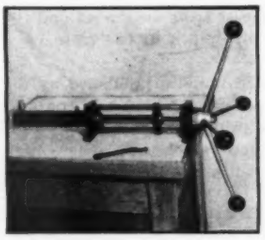
Wm. Loeb, Jr., has been elected a director of the Reo Motor Car Co., Lansing, Mich., to fill the unexpired term of his father, who died recently. Wm. Loeb, Sr., was secretary to President Theodore Roosevelt and later a director of important corporations.

Frank Piatt has resigned as president of the American Refractories Institute in Pittsburgh, Pa., to become a vice president of the Mexico Refractories Co., Mexico, Mo.

The Wilson Manufacturing Co., Wichita Falls, Tex., has appointed Guy E. Daniels export sales representative, with offices at 30 Rockefeller Center, New York.

Walter Ruska Introduces New Volumetric Mercury Pump

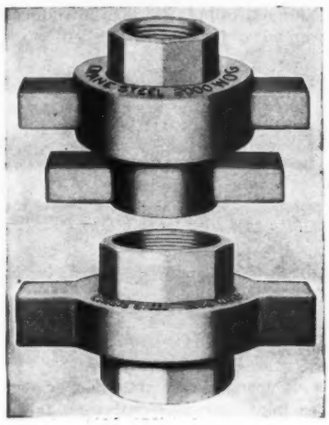
Walter Ruska & Co., Inc., Houston, Tex., have placed on the market a new volumetric mercury pump for laboratory work and petroleum engineering, such as experimentation with oil samples under bottom-hole conditions, pressure treatment of core sections and accurate volumetric measurements under pressures up to 7,000 pounds per square inch. These pumps are screw-feed plunger pumps built in two sizes of 100 cc. and 250 cc. volume displacement. They can be furnished with or without calibration. The calibrated pumps are graduated on the tierod in cubic centimeters. A dial on the operating handle is graduated to .01 cc. The steel feed-spindle is accurately machined and has a two-millimeter pitch. The end thrust is taken up by precision Timken roller bearings. The pumps can be furnished with a case-hardened or hard chrome-plated plunger. The pumps provide an accurate measuring instrument for volumes under pressure or for building pressure in laboratory experiments.



In addition to these pumps the company furnishes pressure vessels and high-pressure core-holders for laboratory work with core sections and oil under high pressure.

Hammer-Lug Steel Unions Are Addition to Crane Products

Another addition to the family of Crane products is a new line of hammer-lug unions. Actually these unions comprise two distinct lines of forged-steel screwed unions, one with one set of lugs, and the other with two sets. Both have been designed for use in piping systems requiring frequent or quick dismantling, either to save time or for emergency purposes. In either case a blow with a hammer upon the lug will break the joint immediately without using a wrench.



In the oil industry these unions save much time and labor in field work around the boiler, because frequently a complete unit has to be dismantled in a hurry and moved to a new location. The lugs add to the convenience in breaking a joint in cramped spaces where there is not sufficient clearance for a wrench.

The single-lug unions are made with forged-steel tailpieces and thread-pieces in sizes 2-, 2½-, 3- and 4-inch (these parts are of cast steel on the 4-inch size) and have lugs on the union ring. The double-lug union is all forged steel, having lugs on both the union ring and the thread-piece. It is made in three-eighth inch, one-half inch and three-quarter inch sizes.

EQUIPMENT DISPLAY NOW VISITING MAN IN THE FIELD

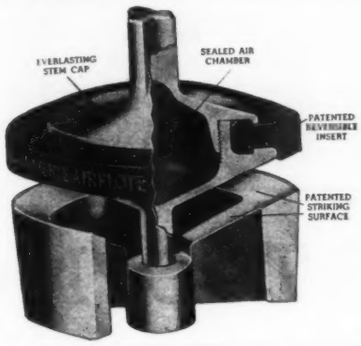
A novel method of presenting oil industry equipment to prospective users has been inaugurated by the W-K-M Co., Houston, Tex., through the use of an equipment display coach, outfitted with standard-size tools (or models in the case of large products) of the company, for field tours. This display coach, drawn by a regular field sales car, presents the W-K-M line of products in the same manner as an oil exposition booth, and means taking W-K-M's "oil show" to the man in the field. Educational pictures of the oil industry will be shown in the coach.

E. L. MacBlain, W-K-M sales engineer, is in charge of the traveling display, assisted by company representatives in the various districts as they are visited. The coach is designed to meet the convenience of the field man, being driven right on the lease or in front of the district office. Beginning recently in the fields of South Texas, the display coach is making a national tour of the fields.

Included in the coach display is the W-K-M through-conduit lubricated gate-valve line, rotary friction slips, tubing-slips and spider, casing centralizer, round kelly drive, brake-lining, twin-seat slushpump valve, Everlasting blowoff valves, and other W-K-M products.

More Displacement and Less Weight in Airflote Valve

An improved slushpump-valve, the Airflote, developed and patented by the MacClatchie Manufacturing Co., has an air-chamber constructed in the



body of the valve itself. The arched construction not only adds greater strength and rigidity to the body of the valve, but decreases the weight of the valve and increases the displacement. In air the valve is approximately 20 per cent lighter, and when submerged in fluid, the difference in effective weight becomes even greater because of the larger displacement and greater buoyancy of the valve.

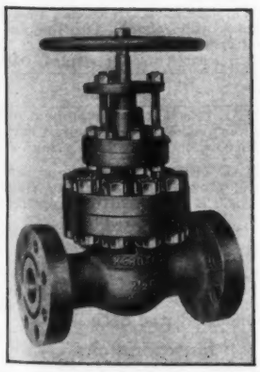
The reduced weight improves the efficiency and life of the valve by reducing destructive hammering and increasing sensitivity to slight changes in the fluid movement. Quicker seating and less fluid slippage at each reversal of the pump-stroke are results of the increased sensitivity.

The Airflote valve's outer edge is thicker than heretofore, and is designed to withstand the high impact strains and terrific cutting action of high-pressure fluids in today's deep-well pumps. Another feature is the large-diameter thread by which the various parts are held together. This thread has a shoulder like a tooljoint. It is leakproof, will not jar loose, and yet can be readily unscrewed when desired to change rubbers.

Many of the MacClatchie features of past years have been retained. The valve has reversible rubber inserts to provide double life and double efficiency, and it has the large streamline striking surface on the valve seat, lengthening the life of the entire valve assembly by decreasing the impact stress per unit and by maintaining these parts in proper alignment.

Kerotest Announces Flow-Line Valve for High Pressures

Designed and built for 10,000 pounds test pressure or 5,000 pounds working pressure, the new type G line of valves, announced by the Kerotest Manufacturing Co., Pittsburgh, Pa., is said by the company to represent an outstanding advance in high-pressure valve design and construction.



Every part entering the construction of this new line is said to have been thoroughly tried and proved, and large factors of safety have been provided. All castings are made of heat-treated manganese molybdenum steel with a minimum tensile strength of 100,000 pounds. The stems are heat-treated nickel-steel forgings, and extra-large high-tensile bolting is used throughout. As a result, the Kerotest type G flow-line valves are said to assure great strength, with large factors of safety, and long service under any operating condition.

Fairbanks-Morse Offering New Diesel-Powered Compressor

Fairbanks, Morse & Co., Chicago, has announced a new self-contained, diesel-powered, 210-c.f.m. air-compressor, available with several types of portable and semiportable mountings, for a wide range of applications. This compressor combines the economy and dependability of the F-M model 36-A diesel with the design features of a proved air compressor, making available a compact, light-weight unit that offers maximum efficiency and reliability under all working conditions.

Through application of modern principles of engineering design, the compressor unit has been kept light in weight and small in size, contributing to its portability. Ample bearing surfaces and proper lubrication make possible a long trouble-free life. The water-cooling system is said to assure thorough and uniform cooling in any climate and under any condition.

The compressor is designed to operate at full engine speed, permitting direct connection to the engine without reduction-gears or belts and without sacrificing engine horsepower through reducing the rated speed.

It is available with several types of mounting.

Gun-Perforating Service Takes to Water in Coastal Fields

The newest development in the Lane-Wells Gun-Perforating Service is the barge unit No. 1, operating in the coastal oil fields of Louisiana This utility barge, built by the Pennsylvania Shipyards, provides the first gun-perforating ever done by boat, and was designed at the suggestion of the Texas Co., major operator in the Lake Charles district. The barge can be used in shallow inland channels as well as in open water. Its length, breadth and draft are such that it will negotiate any location canal. It is large enough to ride moderately rough water in open bays.

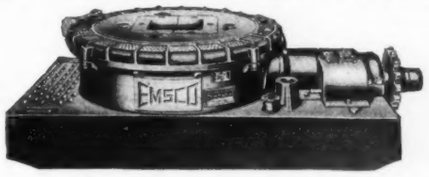
The barge is equipped with all necessary apparatus for maintaining the unit independently of the Lane-Wells Co.'s branch office in Lake Charles, La. This self-sufficiency was made necessary because of the nature of the water locations, their distance from operating points, and the slowness of transportation.

The operating machinery is housed in a substantial cabin built in the streamline style of the Lane-Wells truck. The rear door slides up far enough to allow the shooting cable to leave the drum at any angle from horizontal to vertical. This is a necessity on water location, since most of the time the shooting equipment will be less than 50 feet from the casing. In order to save time and to facilitate tying up, the operating cabin enclosing the hoist is built on a turntable. This allows the crew to tie up at the best mooring place and then line up the hoist for best operating conditions. The hoisting engine and power plant are closed off in a fireproof engine-room for safety and quiet operation. All of the apparatus, including the controls, is placed for maximum efficiency and ease of maintenance. In addition to the operating cabin, there is a shop cabin, which houses various accessories and equipment for reloading the gun chambers.

This unit, the "Ittybitsie W," under the command of "Captain" P. V. Tillbury, is now stationed at the Texas Co.'s operating depot at Montegut, La., from which point it has access to practically all fields in coast waters. The Lane-Wells service is essentially a means for penetrating casing to formation with electrically detonated bullets.

Emsco Rotary Built to Provide More Speed, Less Danger

The Emsco type J-20½ and type JA-20½ fully enclosed rotary machines have been developed by the Emsco Derrick & Equipment Co. to meet drilling conditions that call for faster table speeds with an ample factor of safety. These units incorporate all the valuable features that have been developed by Emsco engineers over a long period of years,



and are built for faster, more efficient, more economical and uninterrupted service. To facilitate easier handling, they are much lighter in weight and more compact than the larger tables, yet built unusually strong to meet the severest drilling conditions. Lifting-hooks on the table end of the base can be folded back when the tables are not in use.

The ring guard is an added feature. Ribs and corrugations are provided in its design to prevent slipping when members of the crew find it necessary to step on the table. It also serves to protect the crew from mud which may fly from the table, and presents a flat surface upon which slips may be rested. A footrest 12 inches wide is welded to the base casting and is left intact should the ring guard be removed.

The table proper is totally enclosed. A special grease-packed seal and the improved construction of the pinion-bearing assembly prevent mud, water or other foreign substances from entering the table. The lower table bearing, pinion-shaft bearing and the pinion-shaft lock are lubricated from a convenient central point through the alemite system. The ring gear, pinion and main table bearing are lubricated by splash-feed.

An important new feature is the preloaded main bearing to prevent hammering of the races when the tables run under light loads or are subjected to bouncing in drilling certain formations.

Design of Hancock Duravalve Marks Departure in Valves

The Hancock Valve Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn., announces what it describes as a revolutionary new type of steel valve, the "Hancock Duravalve." This valve has been developed expressly for high-pressure and high-temperature service (1,500 pounds at 950° F.).

The makers assert that Duravalves with internal Stellite seats put an end to valve maintenance due to steam leaking between the valve-seat ring and the valve-body. The accompanying illustration shows how the radically new design permits the Stellite seat facing to be easily welded in and serviced even on small valves.

Hancock Duravalves are made in one basic size and then tapped, or bored for welding, for one-half-, three-quarters- or 1-inch pipe. The builders state that this simplification will take care of 90 per cent of the small-valve requirements on any high-pressure power plant job, and that it cuts repair part stocks and maintenance parts.

November

16—New York, Oil Trades Association of New York.

19—Tulsa, Mid-Continent Oil and Gas Association membership meeting, Tulsa Club.

December

6—Memphis, Tenn., National Asphalt Congress.

6-10—New York, American Society of Mechanical Engineers.

6-11—New York, Exposition of Chemical Industries, Grand Central Palace.

7-9—Omaha, Neb., Nebraska Petroleum Marketers, Inc.

8-10—Flint, Mich., S.A.E. National Production Meeting.

14—Tulsa, annual meeting of directors of Mid-Continent Oil and Gas Association.

Oil Man's Calendar

1938

January

13—Oklahoma City, Independent Oil Jobbers Association of Oklahoma.

17-21—Cleveland, Ohio, American Road Builders Association.

24-25—Minot, N. D., Northwest Petroleum Association, North Dakota Division.

27-28—Minneapolis, Minn., Northwest Petroleum Association, Minnesota Division, Hotel Radisson.

February

(?)—Louisville, Ky., Kentucky Petroleum Marketers Association.

(?)—Columbus, Ohio, Ohio Petroleum Marketers Association.

March

7—Rochester, N. Y., American Society for Testing Materials, Spring Regional Meeting and Group Committee Meetings.

16-8—New Orleans, twenty-third annual meeting, American Association of Petroleum Geologists, Roosevelt Hotel.

April

13-15—Cleveland, Ohio, National Petroleum Association.

13-15—Houston, Tex., Petroleum Industry Electrical Association.

17-21—Dallas, Tex., American Chemical Society.

20-22—Buffalo, N. Y., American Institute Mining and Metallurgical Engineers, Open Hearth Conference.

CLASSIFIED ADVERTISING

Leases and Drilling Blocks

New Texas Oil and Gas Leases. Large or small tracts for brokers and salesmen. State requirements. H. H. WHITE, P.O. Box 674, San Antonio, Texas.

SECURITY ABSTRACT COMPANY
El Dorado, Arkansas
Fee, Lease & Mineral Ownership on short notice. Ownership maps.

ILLINOIS

A complete weekly report on Illinois operations.
One month.....$5.00
Six months.....$25.00
Sample report on request.
OIL NEWS SERVICE
P. O. Box 146 Flora, Illinois

ARKANSAS
Does not have any production (proration) restrictions. The opportunity for quick "payouts" is obvious. Come here and investigate royalty and lease opportunities
WILLIAM MONROE LAYTON
P. O. Box 411 Texarkana, Ark.

CAN FIND any oil structure that will produce when penetrated. P. O. Box 303, Tonkawa, Oklahoma.

New Mexico OIL LEASES WHOLESALE 40 acres at a time.
Roy G. Barton, Clovis, New Mexico.

Specializing leases twenty acres up dollar acre, East Tex., La., S. Ark. Owners—Attorney, Box 1122, Little Rock, Arkansas.

I HAVE two block of leases which I will sell for a drilling contract to 3500 feet, said leases located in Hamilton County, Illinois. If interested write or call on George W. Hogan, Jr., McLeansboro, Illinois.

FOR SALE — Large spread leases and non-developed royalties; Okla., Kan., Texas. 508 Ritz Bldg., Phone 2-0156, Tulsa.

THREE PROVEN LOCATIONS to drill, 1900 feet, Branyon Field, Caldwell County, Texas. Allowable 75 bbls. per day. Will give one half interest for immediate development. Address Box J-105, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—East Kansas Gas Properties, including Booster Station; 68 gas wells; approx. 7000 acres; monthly income $1200. KANSAN OIL CORP., 302 Midland Bldg., Kansas City, Mo.

LEASE — Royalty near Paluxy-Trinity sand test East Texas quick action gamble 50 for one. E. CROFT, PROCTOR, TEXAS

DRILLING BLOCKS
On lease spreads in the Permian Basin or in the North Texas district.
JAMES T. CUMLEY
Brown Building, Wichita Falls, Texas

FOR SALE BY OWNER, Ten year paid up oil and gas lease, Brewster County, Texas; 40 acres and up at $1.00 per acre. Also royalty at reasonable prices. Address G. C. DAWSON, 1207 Bailey Ave., San Antonio, Texas.

FOR LEASE, 125 acres joining Darrow field. South of gusher. Write Bella Landry, 516 Iberville St., Donaldsonville, La.

I HAVE two blocks of oil and gas leases. One in the Panhandle of Texas and one in New Mexico, which I will sell for a drilling contract, or will put up the acreage for someone to drill for half interest. CHARLIE PRIOLO, 2301 W. 6th St., Amarillo, Texas.

Leases and Drilling Blocks

ONE HUNDRED SIXTY ACRES
In heart of Clay City-Noble, Illinois pool, close to production. Want action and over ride. Fee Holder. Box J-122, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE Oil producing leases with many locations yet to drill, leases for sale near production and wildcat leases for drilling contracts.
W. P. HARLEY
Bowling Green, Ky.

LARGE drilling blocks, gas well, showings. Royalty, leases, sale, trade, Concordia, Tensas, Catahoula Parishes. JOHN DALE, Vidalia, Louisiana.

FRIO COUNTY—TEXAS
Oil and Gas Lease for Sale by Owner

5700 acres of land in Frio County, Texas, located near center of Amerada Block with Gas Well, making distillate and some oil, drilled near center of this block. Will lease all or part of this tract. Part cash, balance oil payment.
Write FRANK DOERING, Temple, Texas.

OWN 2,000 acres N. Pittsburg, Atoka Cos., Okla. 40 to 1,000 A. tracts, lease, royalty or land $5 to $25 per A. ½ cash, ½ oil. Townsite on 2 RRS. near production. J. E. CAVANAGH, Baker, Oregon.

HAVE several good lease blocks in Illinois that can be had on drilling contract. If interested write care Box 223, Vandalia, Illinois.

FOR SALE — OIL PRODUCING lease with more locations to drill, property is near a large proven field in Kansas. If interested address Box J-123, The Oil and Gas Journal, Tulsa, Oklahoma.

Leases and Drilling Blocks

WANTED—Producing Eastern Oil lease for $20,000 cash. Write full information, Box 7342 Oakland, Pittsburgh, Penna.

NEW MEXICO OPPORTUNITY — The well-known Tome Structure, Eastern Valencia County, is now being developed. This is estimated to be one of the first and largest recognized structures in State. Shallow drilling already completed verifies every geological prediction. Extensive development already started.

A limited amount of acreage on this structure is available, including offset acreage and drilling blocks. Consult RINGLE DEVELOPMENT CORPORATION, owner, P. O. Box 286, 'Phone 3365, Albuquerque, New Mexico.

AVAILABLE FOR IMMEDIATE ACTION

Working—interest or offset acreage in 2300 ft. Niagara well. Will be completed in 10 days. Good geology, on general anticline, close to big well and gas wells in Niagara formations. Will sell any part on basis of $5,000 for one-half interest. Offset acreage at $25 per acre. Money to be paid upon completion of well to Niagara lime. Others drilling offset now! No promotion, save one-half, buy from owners. Wire for particulars. This property will be gladly shown for approval. L. J. LOYD, 940 Wabash Ave., Terre Haute, Indiana.

FOR LEASES AND ROYALTIES in Jasper and Newton counties, Texas, address P. O. Box 372, Jasper, Texas.

1,000 ACRES GIVEN FREE for a Niagara test well, Southern Vigo Co., Ind. Other acreage. Jesse Allen Pimento, Ind.

Leases and Drilling Blocks

DIXIE GAS AND OIL TRACTS No. 1 & 2
1,280 lineal feet available. 2 wells, cracking plant. South Lake well area well, Groveland, Fla. Schlumberger tested. Commercial quantities. 2 miles R.R. ⅛ royalty. State terms, particulars. Henry P. Noyes, St. Cloud, Fla.

Patent Attorneys

JACK A. SCHLEY
PATENT LAWYER
Patents Obtained — infringement practice in all Courts—oil field experience. 1807-11 Tower Petroleum Bldg., Dallas. 2014 Second Nat'l. Bank Bldg., Houston. 707 Insurance Building, San Antonio. 433 Munsey Building, Washington, D. C. Address any of these offices.

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United States and Canada
Before disclosing your invention to any one, send for blank form:
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Mailing Lists

ROYALTY INVESTORS, by deed. Speculators in low priced leases. Both by states. Oil Industry Mailing List Co., Tulsa Loan Building, Tulsa, Oklahoma.

Incorporations

DELAWARE CHARTERS: Complete service $35. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Delaware.

CHARTERS — Delaware best, quickest, cheapest, more liberal. Free forms. Colonial Charter Co., Wilmington, Del.

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Classified Display is set with a border and may be used in one or two column sizes.

1 Inch	*1 time*	*$5.00*
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1 Inch	*26 times*	*4.00 per inch*
1 Inch	*52 times*	*3.50 per inch*

This space may be contracted for over a period of one year from the date of the first insertion and is PAYABLE IN ADVANCE, MONTHLY.

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Classified advertising rates: First insertion, 35 cents a line; each additional insertion, 25 cents a line, PAYABLE IN ADVANCE. Six words usually make a line. Count as a word each one-letter word and each group of figures. White-space computed at regular line rate. Allow two extra lines for blind ads. Ads of less than three lines not accepted. No formal acknowledgement is made, and proofs cannot be shown in advance of publication.

	1 time	2 times	3 times	4 times
3 Lines	*$1.05*	*$1.80*	*$2.55*	*$3.30*
4 Lines	*1.40*	*2.40*	*3.40*	*4.40*
5 Lines	*1.75*	*3.00*	*4.25*	*5.50*
6 Lines	*2.10*	*3.60*	*5.10*	*6.60*
7 Lines	*$2.45*	*$4.20*	*$5.95*	*$7.70*
8 Lines	*2.80*	*4.80*	*6.80*	*8.80*
9 Lines	*3.15*	*5.40*	*7.65*	*9.90*
10 Lines	*3.50*	*6.00*	*8.50*	*11.00*

We reserve the right to withhold all advertising of questionable character. To avoid delay be sure to send remittance with copy. We will set your ad in the smallest amount of space possible and refund all overpayments. One-time insertions will not be run until fully paid. Forms close MONDAY NOON before each issue date.

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma